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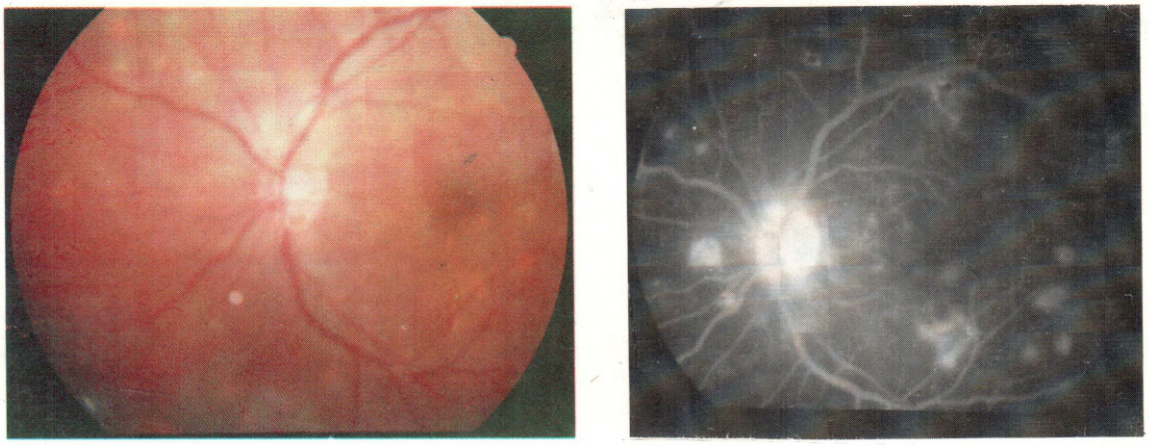

*At Page 78 Figures 1 & 4: Fundus photograph & fluorescein angiogram in APMPPE*

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# PAKISTAN JOURNAL OF OPHTHALMOLOGY





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**Editorial**

# Vision Screening Programs

*See also pp..... 62-68*

As ophthalmologists we hold close to our hearts a desire to maintain or improve, whenever and wherever possible, the visual well-being and welfare of our patients as well as the public at large. One such goal is to be able to study and evaluate the visual status of a segment of population at risk of having visual deficit. Another would be a natural sequel to the first one, i.e., after having identified the problem, to be able to do something about it regarding the cure and, what would be even more desirable, institute preventive measures to preempt visual deficit from progressing, as well as trying to reverse the deficit whenever possible. Availability of a captive segment of population for such studies can be quite helpful if financial resources are of no concern. School Vision Screening Programs, thus, have been undertaken in several communities in several countries as Public Health Projects, funded by local, provincial and national governments. The purpose has been to identify those with visual handicap, amblyopia and strabismus, at an early age, so that these may be corrected while a window of opportunity is still open. Amblyopia lends itself to treatment only for a limited period of time. Though a reversal of amblyopia has been seen to occur up to seven or even nine years of age[1], certain studies indicate that, for best results, treatment should be completed before the age of 2 years[2-4]. So, for most of those at risk, amblyopia detected during the School Screening Programs may be irreversible and its treatment may not be as cost-effective or beneficial as one might hope. One must then expand this search to an earlier age group, namely the preschool children. This poses further problems, as indicated in a related article in this issue of the Journal, not only since one has to deal with a noncaptive segment of population, but also for tactical and financial constraints, as well as lack of valid screening tools for preschoolers. Even with better funding and screening methods, only around 20% of preschoolers in the U.S.A. receive vision screening every year[5]. In developing countries, like ours, where even School Vision Screening is almost nonexistent, undertaking a preschool vision screening might at first thought be considered an outlandish project. But any attempt to gain first-hand knowledge, even if it finally proves the futility of the project, must not be derided, since it is done as an honest effort to avert visual handicap. We can set goals for ourselves that are desirable and may find them not achievable--at this point in time at least. Even though we have to be realistic, there is nothing wrong in being idealistic. If the project is finally considered to have a negative cost-benefit ratio, so be it. At least one can gain from the positive points in it. For example, a methodology will have evolved, pitfalls identified and need for improving screening tools and techniques highlighted. One can then hope and look for financial resources to fund a better designed project which may help us achieve our hearts' desire--the maintenance and improvement of the visual well-being and welfare of our patients and our communities at large.

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*Jehangir Durrani*

# Causes of Failure of Visual Rehabilitation in Pseudophakic Patients: A Review of 100 Cases

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## ABSTRACT

*Among the 100 cases included in this study, 87 achieved the best-corrected visual acuity of 6/12 or better. Visual acuity between 6/18 and 6/60 was achieved in 9 patients. 4 patients could not achieve visual acuity better than counting fingers. The causes for persistent poor visual acuity in these patients were age-related macular degeneration in 3, diabetic maculopathy in 3 and retinitis pigmentosa in 1 patient. These could not be detected preoperatively because of dense cataracts. One patient had a sudden loss of vision 2 weeks after surgery and was diagnosed as a case of central retinal artery occlusion. The main complications related to the procedure causing poor visual outcome were corneal decompensation in one patient, inferior dislocation of IOL in one and cystoid macular edema in two patients. In one patient, no cause for poor vision was detectable . We think amblyopia might be the cause for poor vision in this patient.*

*This study not only puts emphasis on avoiding the peroperative complications, but also helps us in recognizing the significance of complete preoperative checkup both ocular and systemic, as well as preoperative patient counseling regarding the visual prognosis in those with preexisting detectable ocular pathologies.*

## INTRODUCTION

Intraocular lens (IOL) implantation has become the method of choice in patients undergoing cataract surgery throughout the world, because it is a visually rewarding procedure. Spectacle lenses were better accepted until 30 years ago for two reasons: first, no other method of optical correction of aphakia was available, and second, cataract surgery was rarely performed before the cataract was fully mature or nearly so in one eye, and the vision was greatly reduced in the second eye, so that improvement in vision appeared dramatic to the patient and, therefore, his psychologic adjustment to aphakia was easier. When spectacles are provided, the visual acuity may be good, but the patients face the problems of enlarged images, prismatic and aberrational effects, limited visual fields, roving ring scotomas and impairment of judgment of distances leading to clumsiness with simple tasks. Also, there is no prospect of binocular vision if the other eye is phakic with good vision[1,2]. Contact lenses overcome many of these problems, but most aphakic patients are old and slow to adapt and learn. Also, contact lenses are unsuitable for use in dusty environment and most unilateral aphakic patients stop wearing a contact lens within 2 years[3]. An appropriate lens placed within the aphakic eye gives an optical correction which is closer to normal vision than is possible by any other method. If this can be done with safety, it represents a very substantial improvement in the management of cataract[4].

The causes of failure of visual rehabilitation in pseudophakic patients can be grouped into those due to IOL complications, and those due to preoperative ocular and systemic diseases.

Complications related to IOL can be viewed from three standpoints: prevention, recognition and management. Complications related to IOL are conveniently divided into operative, early postoperative and late postoperative. The various operative complications include small wound size and large nucleus, anterior chamber hemorrhage, constriction of pupil, rupture of posterior capsule and vitreous loss etc. The early postoperative complications include striate keratopathy, pseudophakic pupillary block glaucoma, flat or shallow anterior chamber, uveitis and endophthalmitis. The late postoperative complications include capsule opacification, cystoid macular edema, late uveitis, hyphema, glaucoma, corneal edema and lens dislocation etc.

Because this study was on patients aged 60 years or above, age-related macular degeneration (AMD) may be a cause of decreased visual acuity in a pseudophakic patient. In this study, controlled diabetic and hypertensive patients were also included. Certainly advancing diabetic retinopathy and

hypertensive retinopathy may later lead to decreased visual acuity in a pseudophakic patient.

## PATIENTS AND METHODS

This study included 100 eyes in which intraocular lenses were implanted after cataract extraction, and was conducted at the Shaikh Zayed Postgraduate Medical Institute, Lahore, from October 1995 to January 1996, with a follow-up of 3 months to 6 months. Ages of patients at the time of surgery were within a range of 60-95 years. 61 were male and 39 were female.(Table-1). 20 patients were diabetic and 13 had hypertension. (Table-2).

**Table-1: Sex Distribution.**

| Sex | No. of Cases |
|---|---|
| Male | 61 |
| Female | 39 |
| **Total** | **100** |

**Table-2: Incidence of Associated Diseases.**

| Diseases | No. of Cases |
|---|---|
| Diabetes | 61 |
| Hypertension | 13 |

All these problems were well controlled before subjecting the patients to surgery. Patients with active uveitis, history of trauma, history of previous intraocular surgery, corneal diseases, like dystrophies, scars, opacities etc, and posterior segment diseases, like advanced glaucomatous cupping, retinal detachment etc, were excluded from the study. A complete ophthalmic assessment was done. Visual acuity was tested by the Snellen chart, extraocular movements were checked and cover test performed to look for fixation pattern. Slit-lamp biomicroscopy was done in all cases. Intraocular pressure was recorded by applanation tonometry. Keratometry and ultrasonic axial length measurement for biometry were performed. The power of IOL to be implanted was determined by the "Calculation" method. SRK formula was used for this purpose.

Facial block and retrobulbar anaesthesia were given using 2% xylocaine with 1: 100,000 adrenaline in non-hypertensive and without adrenaline in hypertensive individuals. Pupils were dilated with 1% tropicamide and 10% phenylephrine eye drops in non-hypertensive patients and with tropicamide alone in hypertensive patients.

Fornix-based conjuctival flap was made. 10-12mm half-thickness incision at the posterior limbus was given. Can-opener type anterior capsulotomy was done in the closed anterior chamber with 27 gauge bent-tipped needle. The incision was then converted to a full-thickness one. The nucleus was removed by expression, by applying alternating pressure at the limbus at 6:00 and on the sclera at 12:00 positions. Residual cortex was irrigated and aspirated with balanced salt solution (BSS) using a Simcoe cannula. IOL was inserted with the help of viscoelastic material. Pupil was constricted with intraocular miochol injection where necessary. Subconjunctival injection of 20mg gentamicin and 20mg depot medrol was given. Antibiotic and steroid eye drops were instilled and a patch applied. Oral antibiotic and indomethacin were given for five days and topical antibiotic and steroid eye drops for six to eight weeks. Patients were discharged on the first or second postoperative day. The postoperative follow-up visits were at weeks 1,3,5 and 8. Visual acuity with IOL and pinhole was recorded at each visit. Refraction was done at 8 weeks after surgery and sutures were cut if astigmatism measured more than 2.50 diopters. In that case the refraction was done at 10 weeks.

## RESULTS

Eight weeks postoperatively, 38 patients achieved a visual acuity between 6/6 and 6/12 with IOL alone, while 6/18 to 6/60 vision was present in 46 patients and a visual acuity of CF to perception of light was present in 16 patients.(Table- 3)

**Table-3: Postoperative Visual Acuity With IOL Alone**

| Visual acuity | No. of Cases |
|---|---|
| 6/6 | 12 |
| 6/9 | 16 |
| 6/12 | 10 |
| 6/18 | 22 |
| 6/24 | 12 |
| 6/36 | 09 |
| 6/60 | 03 |
| <6/60 | 16 |
| **Total** | **100** |

Twelve patients required no overcorrection for distance vision. 60 patients required ±2.00 spherical equivalent for best-corrected visual acuity. The rest (28 patients) required overcorrection above ±2.00 diopters (Table-4).

**Table-4: Postoperative Refraction.**

| Overcorrection | No. of Cases |
|---|---|
| +2.25 - +4.50 | 12 |
| +0.25 - +2.00 | 20 |
| Plano | 12 |
| -0.25 - -2.00 | 40 |
| -2.25 - -5.25 | 16 |
| Total | 100 |

Final visual acuity of 6/6 - 6/12 was achieved in 87 patients. Visual acuity between 6/18 and 6/60 was present in 9 patients, whereas 4 patients had < 6/60 vision (Table-5).

**Table-5: Postoperative Corrected Visual Acuity.**

| Visual Acuity | No. of Cases |
|---|---|
| 6/6 -6/12 | 87 |
| 6/18 - 6/60 | 09 |
| C.F. - P.L. | 04 |
| **Total** | 100 |

For the purposes of description, we divided these patients into two groups. Patients having visual acuity of 6/6 to 6/12 were designated as group A, while patients having visual acuity of 6/18 or less were designated as group B (Table-6).

**Table-6: Postoperative Corrected Visual Acuity.**

| Visual Acuity | No. of Cases | Groups |
|---|---|---|
| 6/6 - 6/12 | 87 | A |
| 6/18 or less | 13 | B |
| **Total** | 100 | - |

We examined the patients in group B in detail and looked for the causes of their reduced visual acuity. Table-7 shows the complications looked for and their incidence related to the anterior segment of the eye. The various complications which we noted were, keratitis in 5 patients, anterior uveitis in 4 patients, raised postoperative intraocular pressure in one, residual cortical matter in one, posterior capsule rent in three patients, peaking of pupil in 2, posterior capsule thickening in 4, decentration of intraocular lens in one, and pigment dispersion in 3 patients.

**Table-7: Complications.**

| Complications | No. of Cases |
|---|---|
| Keratitis | 05 |
| Anterior uveitis | 04 |
| High IOP | 01 |
| Residual cortical matter | 01 |
| Posterior capsule rupture | 03 |
| Peaking of pupil | 02 |
| Posterior capsule thickening | 04 |
| Decentration of IOL | 01 |
| Pigment dispersion | 03 |

Table-8, shows the complications related to the posterior segment. Age-related macular degeneration was noted in 3 patients, diabetic maculopathy in 3 patients, cystoid macular edema in 4, retinitis pigmentosa in one, central retinal artery occlusion in 1 patient and in one case the reason for poor vision, we think, was amblyopia.

**Table-8: Causes of Poor Visual Results.**

| Diseases | No. of Cases |
|---|---|
| Macular lesion (age-related) | 03 |
| Diabetic maculopathy | 03 |
| Cystoid macular edema | 04 |
| Retinitis pigmentosa | 01 |
| Central retinal artery occlusion | 01 |
| Amblyopia | 01 |

**Table 9: GROUP "B" PATIENTS: Preoperative, Intraoperative and Postoperative Findings in Eyes with Decreased Visual Acuity after Cataract Surgery with IOL implantation.**

| | | PREOPERATIVE | | INTRAOPERATIVE | | POSTOPERATIVE | |
|---|---|---|---|---|---|---|---|
| Patient No. | Age (Yrs) | Visual acuity | Coexisting ocular Pathology | Surgeon | Complication | Visual Acuity | Causes of visual acuity loss |
| 1 | 72 | 3/60 | Diabetic retinopathy | Less experienced | Improper handling of tissues | 6/24 | Bullous keratopathy |
| 2 | 65 | 6/60 | None | Experienced | Posterior capsule rent | 6/18 | Cystoid macular edema |
| 3 | 70 | 4/60 | None | Less experienced | Posterior capsule rent | C.F. | Decentration of IOL |
| 4 | 72 | P.L. | Capsular glaucoma | Experienced | None | 6/60 | Age-related macular degeneration |
| 5 | 95 | C.F. | None | Experienced | None | 6/36 | Age-related macular degeneration |
| 6 | 66 | 3/60 | Diabetic retinopathy | Experienced | None | 6/18 | Diabetic maculopathy |
| 7 | 60 | C.F. | None | Less experienced | Posterior capsule rent | C.F. | Cystoid macular edema |
| 8 | 61 | C.F. | None | Experienced | None | C.F. | Retinitis pigmentosa |
| 9 | 65 | C.F. | None | Experienced | None | C.F. | Amblyopia |
| 10. | 75 | 4/60 | None | Experienced | None | 6/24 | Age-related macular degeneration |
| 11 | 70 | C.F. | Diabetic retinopathy | Experienced | None | 6/60 | Diabetic maculopathy |
| 12 | 64 | C.F. | Diabetic retinopathy | Less experienced | None | 6/18 | Diabetic maculopathy |
| 13 | 70 | C.F. | Diabetic retinopathy | Experienced | None | P.L. | Central retinal artery occlusion |

## DISCUSSION

Striate keratitis occurred in 5 cases. We attribute this, among other causes like improper handling of tissues, to the use of low quality viscoelastic, as well as low quality I/V solutions. Balanced salt solution with 0.5ml of 1:1000 adrenaline added to 500ml is an excellent fluid for irrigation and aspiration of lens matter and also for the removal of viscoelastic. It also provides adequate pupillary dilatation peroperatively. Ringer's lactate solution, in our experience, was not suitable for irrigation and aspiration, as it caused clouding of the cornea and thus compromised the view. Keratitis involved the upper half of the cornea, responded well to the use of 0.1% prednisolone eye drops and gradually subsided over a period of 2-3 weeks. 4 cases got better with the frequent use of local steroids, but one case (i.e., Patient no.1) got bullous keratpathy later on. The incidence of this complication has been reported to be 0.1% to 1%. Morphologically, eyes with decompensated corneas reveal degeneration of endothelial cells, abnormal proliferation of posterior collagenous layer and edema of stroma and epithelium. Surviving endothelial cell area is less than 50%[5].

Recurrent anterior uveitis was seen in 4 cases. Uveitis responded well to local depot steroid and systemic NSAIDs. We speculate that early uveitis was a reaction to the lens matter left in the fornices of the capsular bag. Uveitis presenting later than 6 weeks may have a genetic predisposition[6].

Transient elevation of intraocular pressure was noted in one case and was well controlled with antiglaucoma therapy.

Residual lens matter in 1 case anterior to IOL optic was managed by I/A with conventional two-way cannula in the immediate postoperative period.

Posterior capsule rupture occurred in 3 cases, where we attempted to remove the cortical matter maximally, because of hypermature fragile capsules or full infusion current of irrigation fluid. However, we were able to manage posterior capsule rupture without vitreous loss and we implanted PC IOLs in the ciliary sulcus in these cases without any further operative complication.

Peaking of the pupil in 2 patients was presumably due to incarceration of the iris in the wound. Pupillary capture was not noted in any case. In the literature the incidence has been reported from 0.9% to 3%[7]. Two useful means of preventing the pupillay capture have been suggested:

- *10 degree angulation of the IOL loops to place the plane of the optic more posteriorly.*
- *Implanting IOL in the capsular bag.*

Posterior capsule thickening was seen in 4 cases and was treated with Nd: YAG laser capsulotomy. In the literature, the incidence of posterior capsule thickening has been reported from 2 to 20%[8].

Decentration of IOL was seen in one case two weeks after the surgery. This patient had posterior capsular rent during the procedure. IOL was removed and replaced by an anterior chamber intraocular lens. Vitrectomy was done and miosis was achieved with intraocular carbachol injection. Two other cases had small decentration and were left alone, as the decentration was insignificant. We did not attempt McCannel suture to the superior loop of the decentered lens. In one F.D.A. study the rate of PC IOL subluxation was reported as 0.4%[9].

Clinical cystoid macular edema was noted in 4 patients and the vision improved to 6/12 over a period of 6 months in 2 of the patients. The remaining 2 patients did not improve upto the desired criteria and so were entered into group B. These patients were treated with oral and topical non-steroidal anti-inflammatory drugs. In the literature, the incidence has been quoted to be 3% - 6%. The incidence of this complication is lower in ECCE than in ICCE[5].

We achieved best-corrected visual acuity of 6/12 or better in 87 patients. This compares well with Yang and Kline's series of 1000 posterior chamber IOLs (91.6%)[10] and Surgidev corporation series of 583 PC IOLs (92.75%)[11]. Visual acuity between 6/18 and 6/60 was achieved in 9 patients. 4 patients could not achieve visual acuity better than counting fingers. The causes for persistent poor visual acuity in these patients were age-related macular degeneration in 3 patients, diabetic maculopathy in 3 patients and retinitis pigmentosa in 1 patient. These could not be detected preoperatively because of dense cataract. One patient (i.e., Patient no. 13), was diagnosed as a case of background diabetic retinopathy (Table-9). No indication of active proliferation was noted at the time of surgery. However, two weeks after surgery, this patient had sudden loss of vision and was diagnosed as a case of central retinal artery occlusion (CRAO). Later on this patient developed neovascular glaucoma and optic atrophy. Initially, four patients developed

cystoid macular edema (CME) but 2 of these improved with short course of systemic and local steroids. The remaining 2 patients did not improve and so were listed in group B. One patient (Patient no.1), developed pseudophakic bullous keratopathy which may be due to compromised cornea and rough handling during surgery (Table-9). In one case (i.e., Patient no.3) posterior capsule (PC) rent occurred, but because PC rent was small and no vitreous loss had taken place, we implanted PC IOL in this case. However, two weeks after surgery this patient had decentration of IOL inferiorly and was diagnosed as a case of "sunset syndrome" (Table-9). In one patient (i.e., Patient no.9) no cause for poor vision was detectable. We think amblyopia may be the cause for poor vision in this patient (Table-9).

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# Corrigendum

In Volume 14, No.1 of the Journal, Fig-2 on page 38 has inadvertently been printed upside down. Also the legend should read:

*"Painless limbal mass on the left eye of an 18-year-old female (case-2)"*

(Instead of an 1-year-old female)

The editors regret the error.

# IOL Implantation in Patients with Fuchs' Uveitis Syndrome

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## ABSTRACT

*Fuchs' Uveitis Syndrome is a chronic intraocular disease affecting approximately 3% of all patients presenting with uveitis[1]. The etiology is unknown but an immunologic basis is suspected[2]. The most common cause of visual loss is cataract, which commences in the posterior subcapsular area. There are many studies which describe the complications and visual outcome following cataract extraction in patients with Fuchs' uveitis, with or without IOL implantation. We describe our experience in 17 such patients who underwent cataract extraction. 11 patients were implanted with IOL after extracapsular cataract extraction (ECCE) and 6 patients received IOL after phacoemulsification. 15 patients achieved a visual acuity of 6/12 or better, 2 had postoperative hyphema which cleared gradually without leaving any sequelae, while 2 had severe postoperative uveitis.*

## INTRODUCTION

Fuchs' uveitis syndrome is a chronic inflammatory disease characterized by a chronic anterior uveitis with hypopigmentation of the involved eye. It may occur from the second decade onwards but typically starts between 30-40 years of age as slow, painless, progressive loss of vision and heterochromia. Small diffuse keratic precipitates resembling stellates, mild anterior chamber reaction and iris illumination defects are observed on slit-lamp. Open-angle glaucoma develops in 25-50% of patients. This is thought to be the most frequently misdiagnosed form of uveitis[3].

It has been considered as a degenerative disorder, but evidence shows that it is an immunologic disorder, perhaps related to depressed suppressor T cell activity. Autoimmune complexes are deposited in the walls of microvessels of iris, resulting in microvascular obstruction and ischemic necrosis of the iris stroma[4]. It is most commonly unilateral but in rare cases it may be bilateral.

## PATIENTS AND METHODS

The records of patients with Fuchs' Uveitis Syndrome operated on for cataract with IOL implantation between 1994 and 1997 were reviewed. The diagnosis of Fuchs' Uveitis Syndrome was based upon findings of scattered stellate white keratic precipitates, mild anterior chamber activity, iris heterochromia and absence of posterior synechiae[5]. Seventeen patients diagnosed as having Fuchs' uveitis syndrome were included in this series. There were 10 males (59%) and 7 females (41%), mean age being 42 years (22-62 years). Nine patients received IOLs after routine extracapsular cataract extraction (ECCE), while 6 patients were implanted with lenses after phacoemulsification. None of the patients presented with bilateral involvement. One of the patients was on anti-glaucoma therapy preoperatively, while two patients were on topical steroid therapy (Maxitrol QID). Gonioscopy was carried out on all patients and two patients showed angle neovascularisation. Six patients who underwent surgery in the latter part of the study were implanted with IOL after phacoemulsification, while 11 patients during the earlier part of the study received implants after ECCE.

## SURGICAL TECHNIQUE

The pupil dilatation was achieved by phenylepherine 10% and cyclopentolate 1% eye drops every 15 minutes, one hour before surgery. All patients were operated upon under local anesthesia. Facial block was achieved by using 6cc of 1:1 mixture of xylocaine 2% and bupivacaine HCL 0.5%. 2cc of the same mixture was used to achieve ciliary block. Corneal section was given in all patients who underwent surgery with ECCE, while scleral tunnel incision was made for the phaco group. In the ECCE group can-opener capsulotomy and in the phaco group capsulorhexis was achieved using a bent insulin needle of 27 gauge, in the closed chamber. In the ECCE group after expressing the nucleus, the cortical material was washed out with a Simcoe cannula and

posterior capsular polishing was achieved with a polisher, while phacoemulsification was performed in most cases by using STOP and CHOP technique. A solution of 2% hydroxypropylmethylcellulose was used for insertion of IOL in both cases. All patients received one-piece IOLs. The ECCE group received IOLs with optic size of 6.5mm with diagonal length of 13.5mm, while the phaco group received IOLs of optic size 5.25mm with diagonal length of 12mm (Alcom LX 10 BD). The ECCE group received 5 radially placed, 10-0 monofilament nylon sutures with buried knots, while the phaco group were sutureless.

All patients received subconjunctival injection of 40mg depot medrol and 40mg gentamycin at the end of the procedure.

Postoperatively all patients received a topical antibiotic steroid mixture six times a day in tapering doses for six weeks. All patients were kept on a mydriatic (cyclopentolate 1%) TID for a week. Oral acetazolamide was given twice a day for the initial 5 days to avoid any rise of intraocular pressure in the immediate postoperative period. In the ECCE group corneal sutures were removed in 8-12 weeks and the patients were given glasses. In the phaco group the refraction was carried out 4 weeks postoperatively.

## RESULTS

Preoperative visual acuity ranged from hand movements to less than 6/60. Postoperatively 15 patients (88%), regained a visual acuity of 6/12 or better.

The patients were followed-up from 6 months to 52 months. The largest follow-up was achieved in the patients who had undergone ECCE with IOL. Since the phaco procedure had been recently adopted, this group had a shorter follow-up.

- Two of the patients could not achieve a visual acuity better than 6/60. The reason in one of the cases was central macular edema and the other had developed a marked vitreous opacification.

- Postoperatively corneal edema was noted in one of the patients which resolved within 2 weeks. The patient belonged to the phaco group and this could be due to the phaco technique rather than the disease.

- Two patients were noticed to have hyphema on the first postoperative day and it cleared within a week. The records showed that they had no angle neovascularisation on gonioscopy. These patients had a transient rise of intraocular pressure and they were put on topical beta blockers on BID dosage. The dose was gradually tapered, until after six to eight weeks, when they did not require any treatment.

- There were no cases of hypopyon. None developed endophthalmitis or pupil block or angle-closure from synechiae.

- Triple procedure (ECCE + IOL + Trabeculectomy) was performed on one patient who had presented with glaucoma preoperatively.

- Three patients presented with pigmentary deposits on lens optics. One of these patients had hyphema on the first postoperative day. These deposits cleared in two patients, while a few ghost cells remained in one patient without interfering with the visual outcome.

- Two patients had visual acuity of 6/18 or less postoperatively. The result of the low visual acuity was posterior capsular opacification. These were dealt with by Nd:Yag laser capsulotomy. These patients achieved a visual acuity of 6/12 or better.

**Table-1: Clinical features of 17 patients with Fuchs' uveitis syndrome**

| Clinical Features | ECCE with IOL (11 Pts) | Phaco with IOL (6 Pts) |
|---|---|---|
| ***Preoperative*** | | |
| Mean age (Years) | 42 | 46 |
| Visual acuity < 6/60 | 9 | 6 |
| Glaucoma | 1 | 0 |
| ***Peroperative*** | | |
| *PCO (Plaque) | 1 | 1 |
| ***Postoperative*** | | |
| Corneal edema | 0 | 1 |
| Glaucoma | 2 | 0 |
| PCO | 1 | 1 |
| Severe uveitis | 1 | 0 |
| **CME | 1 | 0 |
| Endophthalmitis | 0 | 0 |

*PCO = Posterior capsular opacity
**CME = cystoid macular edema

## DISCUSSION

There are many studies [6-13] which deal with the postoperative results in patients undergoing cataract extraction with Fuchs' Uveitis Syndrome. The earlier studies deal with results and complications after intracapsular cataract extraction (ICCE)[14,15], while later studies show results and complications after ICCE with iris-clip lens or irido- capsular lenses[16,17]. Recent studies have addressed complications after ECCE. A few studies show that no complications occur following ECCE[6-9], while Jones[10], Turut et al[11], O'Neil et al[18] show that IOL implants result in complications with Fuchs' Uveitis Syndrome. We compare our results with those of others.

The first report on the use of IOL implant in Fuchs' uveitis syndrome was by Mooney and O'Conner[16] in 1980, who used iridocapsular-fixated IOL implants in ten patients with ECCE and one iris clip lens with ICCE. There have been conflicting reports on the outcome of ECCE technique with or without IOL implantation in Fuchs' uveitis syndrome.

- The 15-case study of Gee and Tabbara[6], ten of whom underwent ECCE with IOL implantation, had no major surgical intraoperative or postoperative complications and all these patients achieved visual acuity of 6/12 or better.

- Jones[10] reported on 30 cases, 20 of whom received IOL implants after ECCE. He advised against implantation in eyes with Fuchs' uveitis and glaucoma.

- Baarsma et al[7], on the other hand, reported on 22 patients who underwent ECCE with IOL, and noted that implantation did not constitute an additional risk factor.

- O'Neil et al[18] (a study on 77 patients) also conclude that the use of IOL is a safe procedure in Fuchs' uveitis syndrome.

In our study 15 patients (88%) achieved visual acuity of 6/12 or better. In comparing our results with those of other authors we noted that, 93% in O'Neil et al[18] series, 73% in Jones[10] series, 95% in Baarsma series, and 100% of patients in Gee and Tabbara[6] study achieved visual acuity of 6/12 or better. While overall results of surgical outcome after IOL implantation are good, certain features peculiar to Fuchs' uveitis syndrome need further consideration.

In our series, we noted hyphema in 2 patients on the first postoperative day, while none had intraoperative hemorrhage. Jones[10] noted intraoperative hemorrhage in 50% of his cases, while Gee and Tabarra[6] noted intraoperative hemorrhage in 13%, Baarsma et al[7] in 9%, while O'Neil et al[18] noted it in 10% of their cases. In our two cases we noted hyphema on the first postoperative day. It is possible that minor hemorrhage during surgery might not have been observed and it came to be noticed on the first postoperative day. Both patients had rise of IOP postoperatively and needed topical beta blockers to keep their IOPs within reasonable limits.

The origin of the hemorrhage is thought to be from abnormal vessels seen on the iris and in the filtration angle. However, their presence is a poor indicator of the development of intraocular hemorrhage during surgery[18]. Both our patients who developed hemorrhage had normal gonioscopic findings, while the two patients who showed abnormal vessels gonioscopically, never developed hemorrhage. Same observation was made by O'Neil[18], who reported that in a series of 77 patients, 19 patients who had abnormal vessels on gonioscopy never developed intraoperative hemorrhage, although two of them showed hyphema on the first postoperative day.

- Severe postoperative uveitis was seen in two eyes, one in the phaco group and one in the ECCE with IOL group. All had received a one-piece PMMA IOL. O'Neil[18] series of 77 patients documented uveitis in 10 eyes (12%). One of our patients had glaucoma preoperatively and he was dealt with with a triple procedure. Glaucoma has been reported to occur in the natural course of Fuchs' uveitis syndrome in 9% to 59% of patients[15,19-21]. It has been found that IOP may be better controlled after cataract surgery[22]. O'Neil series[18] which reports 16 patients (20%) having preoperative glaucoma, confirms this, as only one patient required treatment after cataract surgery.

- Cystoid macular edema (CME) is the major cause of poor visual outcome in patients undergoing cataract surgery with uveitis. The incidence of CME after routine ECCE with IOL is reported to be 2.3% in patients undergoing surgery for age-related cataract[23]. One of our patients had reduced visual outcome because of CME (6%). O'Neil[16] reported CME in 4% of cases, while Foster et al[24] series had CME in 22% of cases with uveitis due to other causes.

- Corneal edema was noted in one case who belonged to the phaco group, but this could be due to the technique of phaco, rather than the disease.

## CONCLUSION

We conclude that IOL implantation following ECCE or phacoemulsification is a safe procedure in Fuch's uveitis syndrome. Microsurgical technique with the use of viscoelastic material and in-the-bag implantation may be responsible for the lower rate of complications in our series. The flare-up of uveitis in postoperative phase does not seem to affect the visual outcome. IOP should be carefully monitored, particularly in patients showing intraoperative bleeding or postoperative hyphema, but the use of an IOL does not result in a higher incidence of glaucoma.

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# Preschool Vision Screening - An Analysis of Screening of 16, 592 Preschoolers

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## ABSTRACT

*Amblyopia and strabismus require treatment early in life for best visual results. At present many such children are treated late or not at all. Mass screening at preschool age appears the only viable solution to this problem. We carried out village-to- village screening of 16,592 preschool children in a rural area. Anterior segment examination and rapid retinoscopy, together with visual acuity checking with Snellen test types, where possible, were utilized as screening tools. The coverage rate was more than 80%. The results show that 22% of these children had some sort of ocular problem, while 3.27% suffered from potentially blinding conditions like amblyopia, refractive error, squint etc. Comparative analysis shows that there is significant underdetection of amblyopia and squint in this group. At the moment, preschool screening does not seem to produce desired results. In order to assess this matter, various vision screening methods appropriate for preschoolers or infants based on current evidence are reviewed.*

## INTRODUCTION

Visual deficit has for a long time been regarded as a disability requiring early detection and intervention, and is generally regarded as an important public health problem. More than 2% of children may be affected by these problems by age two[1].

The principal purpose of vision screening is the prevention of amblyopia, which is the commonest visual disability of childhood[2]. The condition develops as a result of an abnormal image in one or both eyes during the development of the visual path-way, which is thought to be completed by the age of nine[3]. The two most common causes of this abnormal image are squint and unequal refraction in the two eyes. Thus it becomes essential that refractive errors, squint etc. must be corrected before the age of 9.

However, a large percentage of these children go undetected and untreated[4]. Although the need for early detection of these conditions is obvious, yet one must ask: Is it practical to provide professional eye examination on a screening basis for all preschool children?

A number of obstacles are in the way. First, preschool children are a non-captive audience. Second, there is no cost-effective, valid, sensitive and specific screening test which can give optimum results. Third, our priorities in the health sector rule out any such large-scale programme. The enormity of the task can be judged from the fact that even in the USA where preschool vision screening has been one of the most important community service programs since the early 1950s[5], it has been estimated that, at the most, only 21% of preschool children received vision screening each year[6]. The preschool vision screening in Pakistan is almost non-existent and to our knowledge, this is probably the first report on a large-scale screening in this age group in Pakistan.

## METHODOLOGY

Realizing the importance of such programs, Pakistan Center for Prevention of Blindness (PCPB), Al-Shifa Trust Eye Hospital (a WHO collaborating Center for Prevention of Blindness), with financial assistance from International Development and Refugees Foundation (IDRF), Canada, undertook a pediatric vision screening program ``Al-Basarat'' for preschool, school going and non-school going children of Kallar Syedan Region (Tehsil Kahuta, Distt: Rawalpindi), between April 1995 and April 1996. In this article, the results of preschool screening are being presented.

**i. The Target Area**

Kallar Syedan has a total population of 150,000 with 17,000 children under 5 years of age. There are 10 administrative units (Union Councils) in the area, each having one Basic Health Unit (BHU). A total of 16,592 children were examined through a village-to-village screening of each of the 10 union councils. This preschool screening was carried out primarily by our clinical medical officers, while the role of the voluntary workers, like the local teachers, social workers etc. was supportive in nature.

**ii. Pre-Screening Phase**

The sites selected for screening were places like health units, schools, mosques, community elders' residences, dispensaries etc. The publicity was carried out by using various sources like weekly radio talks, articles and advertisements in the newspapers, distribution of handbills and direct communication with the community through our local coordinators, like the vaccinators of BHUs, voluntary trained teachers, local Al-Shifa employees residing in villages, Learning Coordinators (LCs) of the education department and voluntary social workers.

**iii. Screening**

The screening was carried out in 45 sessions over a period of 9 months. Out of 16,592 children, 3,635 were identified to have some ocular problems. Most of them were treated there and then at the field pediatric clinics, while 565 children were referred for specialized management to the pediatric unit of Al-Shifa Eye Hospital (Table-1). The type of examination carried out during the preschool vision screening and criteria for referral are outlined in Table-2.

**Table 1: Screening levels.**

| | |
|---|---|
| **Primary screening** | **16592 children** |
| By Medical Officers | 95% |
| By Vaccinators | 03% |
| By Parents | 02% |
| **Secondary screening** | **3635 children** |
| By Medical Officers | 100% |
| **Tertiary screening** | **565 children** |
| By Ophthalmologist | 100% |

It may be specially mentioned here that throughout our village-to-village screening the voluntary help of BHU vaccinators proved very useful because of their knowledge about the children population of the area. They were also given primary eye care training and some of them, at places, were able to screen out children for further examination.

**iv. Community Eye Health Education**

Simultaneously, we also tried to create community awareness for potentially blinding conditions through comprehensive community eye health education. It was basically aimed at prevention of unnecessary childhood blindness through awareness and self-detection, promotion of eye health by adopting appropriate hygienic measures and mass mobilization to enlist help of the community for our screening program.

**iv. Methods For Evaluation**

Please see Table-3.

## RESULTS

Please see Tables 4 and 5.

## DISCUSSION

Screening has been defined as: "The presumptive identification of unrecognized disease or defect by the application of tests, examinations or other procedures which can be applied rapidly. Screening tests sort out apparently well persons who probably have a disease from those who probably do not"[7]. The goal of primary prevention is to avert the initial occurrence of disease. Although this goal can seldom be met, it is sometimes possible to achieve secondary prevention, that is, to prevent the progression of disease. Screening procedures are a form of secondary prevention that are directed to improve the outcome in disease by early detection and treatment.

The principal purpose of preschool vision screening is the prevention of amblyopia. It is sad that no such program exists in Pakistan to carry out preschool vision screening. On the other hand, such programs are routine in most of the developed countries. Differences in test conditions, skills of examiners, test types and referral criteria result in tremendous variation in referral from primary screening of between 1% and 22% of children seen[8] (22% in the present study). There is widespread concern that current programs even in the United

**Table 2: Composition of the team, type of examination and referral criteria.**

| | Type of examination |
|---|---|
| **Team**<br>- Medical officers 2<br>- Ophthalmic technicians 2<br>- Village vaccinator 1<br>- Registration clerk 1<br><br>**Referral Criteria**<br>- Could not read the majority of the 6/12 line before their 5th birth day.<br>- Has a two-line difference of inter-ocular visual acuity<br>- Suspected/manifest squint<br>- Abnormal light (or red) reflex | **A For the newborn**<br>General inspection of eyes<br>Visualization of red reflex<br>Evaluation of ocular motility<br><br>**B) Six months to three years**<br>Eye fixation preference<br>Cover test<br>Pupillary and light reflex<br><br>**C) Three to Five years**<br>All the above tests<br>Illiterate "E" test/pictures<br>Rapid non-cycloplegic retinoscopy<br>Sheridan - Gardiner |

**Table 3: Methods used for evaluation.**

| Indicators | Outcome | By whom |
|---|---|---|
| i) Turnout of children at pediatric clinic by tallying with census record of Union Council, kept by immunization staff. | i) More than 70% turnout of children in most of the places. Even newborn babies of few days were brought for routine eye examination. | Project Coordinator/ Community Ophthalmologist |
| ii) Response of Parents/Community through qualitative research methods (KAP survey) | ii) 81% of the participants were satisfied with examination and treatment | Ophthalmic Technicians |
| iii) Turnout at Pediatric Unit | iii) Children requiring surgery were reluctant. Sixty percent of the referred children turned out but parents needed a lot of motivation to get their children operated on. | Pediatric Ophthalmologist |
| iv) Number of children who underwent surgery | iv) 52% of those requiring surgery complied with | Community Ophthalmologist |

Kingdom produce too many false negative and false positive results and that these are unsatisfactory[9]. Moreover, there is no absolute yardstick for the diagnosis of amblyopia and squint. So, is there any evidence that preschool vision screening programs are effective in practice? Encouraging results have been reported from trials of community screening by photo-refraction[10] and by orthoptists[11]. A retrospective cohort study in Canada also suggested a reduction in poor vision outcome of 50% after preschool vision screening using the illiterate `E' Test[12]. On the other hand, an evaluation in 1980 of a community program

**Table 4: Ocular problems in 16,592 children.**

| Disease | No. of children | Percentage |
|---|---|---|
| Allergic conjunctivitis | 497 | 3.00 |
| Blepharitis | 705 | 4.25 |
| Trachoma | 995 | 6.00 |
| Epiphora | 871 | 5.25 |
| Refractive error | 250 | 1.51 |
| Squint | 88 | 0.53 |
| Amblyopia | 154 | 0.93 |
| Nystagmus | 26 | 0.16 |
| Congenital anomalies | 23 | 0.14 |
| Aphakia | 7 | 0.04 |
| Cataract | 7 | 0.04 |
| Trauma | 7 | 0.04 |
| Corneal opacity | 3 | 0.02 |
| Optic atrophy | 2 | 0.01 |
| Total | 3635 | 21.92 |

**Table 5: Potentially blinding conditions in 542 children (3.27%).**

| S.No. | Condition | Percentage |
|---|---|---|
| 1. | Refractive error | 1.51 |
| 2. | Squint | 0.53 |
| 3. | Amblyopia | 0.93 |
| 4. | Nystagmus | 0.16 |
| 5. | Cataract / Aphakia | 0.08 |
| 6. | Corneal opacity | 0.02 |
| 7. | Trauma | 0.04 |

relying on clinical medical officers, health visitors and general practitioners, similar to that used throughout England and Wales suggested that such preschool vision screening had virtually no effect on the diagnostic process[13]. There was also evidence in 1984 that 30% or more of important squints and refractive errors remained undetected until after the age of 5 years in a similar program in Newcastle[14]. Recently, Ingram[9] reviewed the evidence and concluded that a screening program at the age of 3.5 years was ``no more effective'' than school screening ``in producing better results''.

We tend to agree with this notion. More so because we have felt that screening young children for amblyopia is a difficult and complex test. Visual functions may not be easily tested in a child who does not yet read, is unable to verbalize well and is uncoordinated. An additional problem is differentiation of immature development of the visual system from vision abnormalities.

A major difficulty in the design of preschool vision screening project is the absence of a captive population, as one has with school children. Ehlrich and coworkers[6] estimated that only 21% of preschool children in the USA received any form of vision screening. The problem is further aggravated when we observe that young children are usually unaware of their visual problem because they have no basis of comparison. Unless defects are cosmetically severe (like wide-angle squint), parents may fail to observe any ocular or visual problems.

On top of that there is little evidence that children with profoundly amblyopic eyes can be successful treated[9]. Taylor[15] has argued that only bilateral visual handicap is socially significant and debilitating, whereas unilateral amblyopia is rarely debilitating, unless there is injury to the other eye, which is uncommon, as shown by Tommila and Tarkkanen[16]. Taylor, therefore, recommends caution when considering a preschool vision screening program lest it be cost-ineffective and divert resources from important research into the cause of amblyopia.

The screening program will have "disbenefits". For instance the program may (a) not be used by the minority at high risk (b) lead to the referral of (and anxiety in) a large proportion of false positives (c) falsely reassure a number of true positives (or false negatives) and (d) identify a group at high risk, who are subsequently lost to follow-up.

**Who Should Do The Screening?**

For preschool vision screening, we have utilized clinical medical officers of our department. The prevalence of potentially blinding conditions in our screened population (3.27%) is considerably lower than generally reported (e.g. 7.1% in EPSDT Program)[17]. In general a conservative estimate of amblyopia is 2% and that of strabismus 4% as compiled by Simons and Reinecke[15]. This is in contrast to the results of preschool screening carried out by the National Society for Prevention of Blindness (NSPB) USA[19], where prevalence of amblyopia was 0.61% and that of squint 0.43%. This is similar to our detection rate of 0.93% and 0.53%, respectively. With comparatively such a small

prevalence detected in this age group by our M.Os, we are inclined towards the opinion of MacLellan and Harker[20] who showed that preschool vision screening by health visitors and doctors produced referrals that were inappropriate in 70% of cases but that screening by orthoptists could decrease this by 25%. Hall et al.[14], in a small study in nurseries, found that orthoptic screening could double the number of visual problems detected in children previously screened, a finding similar to that of Cameron and Cameron[21]. On the other hand, evidence also suggested a lack of any beneficial effect of community orthoptist screening at 5 months of age as compared to that at 35 months of age[22]. However, due to almost nonexistence of community oriented orthoptists in our country, we can utilize the services of voluntary eye workers, like teachers, vaccinators and lady health workers who may be given short-term training as certified screening technicians.

**What Should Be The Screening Methods?**

Vision screening methodology depends on many factors: What are our target conditions, e.g. squint and amblyopia? What will be the rate of underreferral (or sensitivity of the screening test) and overreferral (or specificity of the test) of that particular method? And finally, at what age should children be screened?

A growing body of recent clinical evidence[23-25], however, indicates that normal or near-normal binocular vision can be achieved in many of these cases if treatment for amblyopia and strabismus is not only inaugurated, but completed prior to 24 months of age. Although this evidence makes a strong case for considering screening 3-5-year-old preschoolers and of even children younger than 24 months, yet whether this is technically feasible on the scale required, is not fully established.

A variety of methods can be utilized for screening of preschool children:

1. **Gross Observation**
   Gross observation is one method of screening for strabismus. However, it is estimated that only 50% of esotropic children have a cosmetically noticeable defect[26]. A manifest deviation must be at least 7 degrees to be detected by inspection even by trained clinical observers[4]. Thus gross observation has only 50% sensitivity. As we have noticed earlier, only in 2% of cases children/parents were aware of any ocular abnormality at the time of screening.

2. **Visual Acuity Testing As A Screening Tool**
   Almost 30 methods of visual acuity testing in young children have been proposed and reported[27]. These tests mainly consist of the following groups:

   i. Letter or number recognition (Snellen optotypes singly or in rows)
   ii. Directional (e.g E Test).
   iii. Symbol Matching e.g. STYCAR tests (Screening Tests For Young Children and Retardates).
   iv. Picture recognition (e.g. Allen test).
   v. Stereo acuity testing (Random Dot Stereograms)

   There are certain disadvantages in this method of preschool screening also:

   a. It does not distinguish between reduced acuity due to amblyopia and that due to visual immaturity or simple refractive error.
   b. It will underrefer non-amblyopic children with alternating strabismus or suppression because of normal visual acuity in most of them[4,12].
   c. The use of an occluder causes decreased cooperation in many infants[23].

3. **Refractive Screening**
   Screening of infants and children using traditional retinoscopy has the advantage of requiring only minimal cooperation on the part of the child tested. Ingram[29] used full cycloplegic retinoscopy as a screening technique and found it impractical as it was lengthy and hence costly in terms of referral. Moreover, it is not a direct test for either amblyopia or strabismus and no well-defined correlation exists between the degree of refractive error and these conditions. In a screening of 38,000 children[3] (rapid retinoscopy without cycloplegia and without trial lens), aged 1-2.5 years, 45% of identified esotropes were emmetropic and so would have been missed by refractive screening. Consequently its sensitivity as a screening test is low. However, Mohindra's near retinoscopy techynique[30] without the use of cycloplegic performed with monocular fixation at 50cm on the dim retinoscopy light and employing trial lenses, correlates well with full retinoscopy. Despite some limitations we feel that simple non-cycloplegic retinoscopy is comparatively a useful and cost-effective technique for preschool

children. We have utilized similar criteria as advocated By Olver[31].

With the advent of portable refractometers and photoscreeners[32] the job of refractive screening will become easier. Japanese observers[33] have found autorefractometer quite useful for screening most of preschool children. They advocate retinoscopy only where it is difficult/ impossible to use an autorefractometer, i.e., in children under 2.5 years and those with extreme head tilt. However, the cost is a major limitation. A new optical device, the Focometer seems to be the answer for economically disadvantaged populations. About 25 focometers can be purchased for the price of one autorefractor[34].

4. **Binocular Vision**
   a. Cover Test needs a trained examiner. A screening of 4-year-olds carried out by a pediatrician could not detect a single child out of 44 heterotropes[35]. However, since we had medical officers, who were basically trained in ophthalmology, we found it a quite useful screening tool.
   b. Fixation Preference Tests: With one ye occluded if a child can take up and hold fixation with the other eye, it is considered as a sign of absence of any significant amblyopia. However, even refined versions of this technique, e.g. using 10-D dissociating prisms, have resulted in underreferral[36].

In short, all these tests suffer from one major handicap, i.e. underreferral, which undermines the credibility of screening efforts. The brief attention span and distractibility of young children and infants and related factors in the non-selected population setting of mass screening, argue for an as simple and a straightforward testing format as possible. A pilot comparative study of different screening tests conducted by NSPB, USA at Wisconsin[6] has demonstrated that a multitest screening protocol is feasible for both preschool and school-age screening. Despite utilizing a combination of screening tests, like gross observation, rapid retinoscopy, visual acuity recording, ophthalmoscopy and cover tests etc., we have, as discussed earlier, still ended up with significant underdetection. Although use of a community orthoptist and some of the current stereoscopic tests, like Random Dot Stereograms (RDS), may overcome some of these and other obstacles, we conclude that at present preschool screening of infants and children younger than 4 years in our setup is not cost-effective and results in underdetection.

**Recommendations**

- Vision screening upon first enrollment in public or private schools must be mandatory and it should be the responsibility of the schools that comprehensive health screening is provided to all preschool children free of charge.

- Selected primary-grade school teachers/voluntary workers should be trained for a period of two weeks to become certified vision screening technicians in their own schools till such time that we have enough trained and willing community orthoptists.

- The potential also exists for involving pediatricians and family physicians to reach this non-captive population of preschool children, following a short orientation course on the subject.

- Public education about amblyopia, strabismus and the need for their early detection for optimal treatment is essential.

- A large-scale comparative study of different screening instruments should be undertaken to find the best methodology. [At present Random Dot E Stereogram is considered the best vision screening instrument for preschoolers[37]].

- To be maximally effective, these screening programs should be tied to the immunization programs.

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# Pneumoretinopexy With $SF_6$ as an Adjuvant to Other Modalities for Retinal Detachment Surgery

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## ABSTRACT

*Increasing awareness of the properties of long-acting gases and a closer understanding of overcoming their potential hazards have made gases essential tools in the management of various vitreoretinal problems. From January 1994 to May 1996, of the 84 vitreoretinal surgeries performed at the eye department, Civil Hospital, Karachi, 28 eyes of 26 patients were selected for treatment with intraocular gas. 16 were males (61.5%) and 10 were females (38.5%). Ages varied from 16 years to 68 years with a mean age of 40 years. 16 eyes were phakic, 4 had extracapsular cataract extraction and another 4 had posterior chamber IOL implant. 3 had intracapsular cataract extraction and one eye had a ruptured posterior capsule. One patient had ectopia lentis. History of trauma was present in 2 cases (7%). Myopia more than 3 diopters was present in 7 eyes (25%). In all these cases $SF_6$ gas was used as an adjuvant to other modalities for treating retinal detachment. Anatomical attachment after first operation was achieved in 22 eyes (78%). Of the remaining 6 eyes, two retinae were further attached by subsequent surgeries. The final anatomical success rate was 85.8%. Visual acuity better than 6/36 was achieved in 17 cases (60.7%), while better than 3/60 was present in 22 cases (78.5%). Regarding complications, 7 cases developed lens changes, 5 of which were reversible (7.1%). IOP was raised temporarily in 5 and permanently in one (3.5%). Lid swelling due to postoperative positioning was present in most of the cases. One eye developed endophthalmitis.*

## INTRODUCTION

It is established beyond doubt that expandable gases are an essential tool in the management of retinal detachment[1]. Gases due to their unique properties, not only merit various new indications, but also in selected cases have made the reattachment an outpatient procedure. The surface tension generated at the gas-fluid interface causes functional closure of the retinal break, thus allowing the subretinal fluid (SRF) to be absorbed and the two retinal layers to be reapproximated. Moreover, the buyoant force of the gas bubble not only pushes the SRF out through the break but also actually pushes the retina towards the retinal pigment epithelium (RPE)[2-3].

Gases are not new in the field. The first intraocular injection of air for the treatment of retinal detachment was given by Ohm in 1911[4], at times when retinal breaks were not recognized as the cause of retinal detachment. In 1938 Rossingren used air intravitreally in cases of detachment with recognized retinal breaks. Though he achieved a success rate of 77%, air tamponade did not gain wide acceptance until 1973 when Norton introduced the use of sulpha hexafluoride ($SF_6$) as a long-acting expanding gas. In some cases Norton combined gas tamponade with scleral buckling, while in others only gas and cryopexy were used to seal the breaks. Various expandable and nonexpandable gases are in current use. Among these air, $SF_6$ and perfluoropropane are the most extensively used[3,5]. The reason for choosing $SF_6$ gas for this study was the fact that it is the most extensively studied gas[4]. It has a longer stay with low propensity for lens changes and for inducing proliferative vitreoretinopathy (PVR). Moreover, longer acting gases are slow to expand and so require longer time to achieve therapeutic size of the bubble. Also, longer stay causes visual disability to the patient.

## PATIENTS AND METHODS

From January 1994 to May 1996, 84 retinal detachment surgeries were performed in unit II, Eye Department, Civil Hospital, Karachi. These patients were mainly admitted through the outpatient department of the Civil Hospital, Karachi, while a few were those referred from other hospitals. Out of these 26 patients 16 were males and 10 were females. Ages varied from 16 years to 68 years, the mean age being 40 years. Those patients who were expected not to be

able to maintain the desired postoperative position, children, and those having advanced glaucoma, were not included in the study. Patients having bullous retinal detachment, multiple holes and decreased visibility were considered for gas use. Gas was also used following vitrectomy and to overcome hypotony following subretinal fluid (SRF) drainage.

16 eyes were phakic, four had had extracapsular cataract extraction and another four had had posterior chamber IOLs. Three eyes had undergone intracapsular cataract extraction, while one eye had ruptured posterior capsule. One patient had ectopia lentis.

In eleven patients the retina was totally detached, while in six there was subtotal retinal detachment. In the remaining, detachment was limited to one-half only. Macula was off in 18 patients. Early proliferative vitreoretinopathy (PVR) was present in 8 eyes, while advanced PVR was seen in 9 eyes.

All patients were operated on under general anesthesia for which halothane and nitrous oxide were used. Nitrous oxide was stopped at least 15 minutes prior to injecting $SF_6$ gas, except in one case in which $SF_6$ gas was reinjected at the termination of the operation. After 360 degrees periotomy, recti were secured by 4/0 silk. In 6 eyes 360 degrees encircling strap was applied, while segmental circumferential plomb was applied in 12 eyes. Radial plombs were required in six eyes. In two of the six eyes in which 360 degrees strap was applied, an additional grooved tyre segment was applied circumferentially beneath the strap. Vitrectomy was done in 16 eyes.

SRF was drained in 26 out of 28 eyes. Drainage site was usually inferotemporal. However, in 2 cases SRF was drained from more that one site. After making a partial thickness scleral cut, a 23 gauge needle was pushed obliquely through the choroid and Bruch's membrane. SRF was then milked out by intermittent scleral depression by cotton sticks.

In 4 cases SRF was drained under pressure, so as to avoid hypotony during the procedure, thus ensuring complete drainage of a relatively thick SRF[6]. For this, initially 1cc of air was injected intravitreally and then a 27 gauge needle was pushed through the sclera and choroid. In one patient the retina became incarcerated but it was successfully relieved by making the site of SRF drainage dependent, thus allowing the SRF to widen the subretinal space, and by separating the lips of the drainage site.

5cc of $SF_6$ gas was withdrawn from the cylinder, via a nozzle connected to a micropore filter, into a 10cc syringe. The required mixture was prepared by mixing sterile air with the gas in the syringe.

In this study 50% gas/air mixture was injected in most of the cases. However, in a few cases pure $SF_6$ was also injected. 1.5 to 2.5cc of the gas was required in each case. The site for injection was invariably 3-4 mm from the limbus, usually between superior rectus and medial rectus insertions, as this site was the easiest to keep high while still affording internal visualization by indirect ophthalmoscope. Immediately following SRF drainage and with the contour of the superonasal quadrant maintained by inferotemporal scleral indentation, the sclera and pars plana were penetrated by a 27 gauge needle attached to the syringe. It was pushed until its tip became visible in mid-vitreous by the indirect ophthalmoscope. The needle was then partially withdrawn to leave 1-2mm still penetrated. The gas was then slowly and smoothly injected as a single bubble while the scleral indentation was simultaneously released. This prevented the formation of multiple gas bubbles (fish eggs)[2]. The needle was then completely withdrawn leaving the eye slightly hypotonic. The disc was viewed by the indirect ophthalmoscope to confirm normal flow of blood.

All breaks were surrounded by cryopexy. Explants and the encircling bands were sutured by 5/0 ethibond.

Intraocular pressure was assessed six hours postoperatively by Goldmann tonometer. Indentation tonometry was avoided as it underestimates the intraocular pressure in a gas-filled eye[7]. Patients were examined on the first postoperative day and then daily until the gas was completely absorbed. They were discharged and then followed-up at an average interval of one month. The average follow-up was 10 months.

## RESULTS

A total of 28 eyes were operated on in which gas was used as an adjunct to other modalities. Anatomical attachment after the first operation was achieved in 22 eyes (Table-1).

Of the remaining six eyes two more were treated successfully so the success rate after the first operation was 78.5% and after further operations it rose to 85.7%. Visual acuity better than 6/36 was achieved in 17 cases (60.7%), while 3/60 and better was present in 22 eyes (78.5%) Table-2.

**Table 1: Anatomical results.**

| Operation | NO. of Eyes | Success Rate |
|---|---|---|
| First operation | 22 | 78.5% |
| Final operation | 24 | 85.7% |

Table 2: Visual results

| Visual acuity | Preoperative | Postoperative |
|---|---|---|
| Better than 6/36 | 1 | 17 |
| Between 6/36 and 3/60 | 8 | 5 |
| C.F. | 11 | 1 |
| HM | 6 | 4 |
| PL + ve | 2 | 1 |

In seven cases there were lens changes, 5 of which reversed once the gas was absorbed. Intraocular pressure was raised temporarily in 5 patients and permanently in one. Lid swelling was, however, present in most of the cases which was due to the postoperative positioning. Table-3 enlists the complications encountered during the study.

Table 3: Postoperative complications.

| Complications | NO. of Eyes |
|---|---|
| * Lens changes | 7 |
| Vitreous hemorrhage | 2 |
| Vitreous incarceration (drainage site) | 1 |
| Retinal incarceration(relieved intraoperatively) | 1 |
| IOP increased | |
| Temporary (on the table) | 5 |
| Persistent | 1 |
| PVR (Postoperative) | 7 |
| Migration of gas in SR space | 0 |
| ** Migration of gas in sub-conj. space | 0 |
| Enlargement of retinal tears | 1 |
| Postoperative lid swelling | |
| Mild | 3 |
| Moderate | 4 |
| Severe | 21 |
| Infection (Endophthalmitis) | 1 |
| Corneal haze | 0 |
| *** Redetachment | 6 |

* 4 had lens changes which were totally reversible
1 had traumatic opacity
2 had enhancement of cataract development
** Subclinical amount may be present
*** 2 were attached by subsequent surgeries.

## DISCUSSION

We feel that gases are not given due importance in our vitreoretinal centers. There may be several reasons for this reluctance. Besides being aware of the potential hazards of gases our surgeons also have a feeling of less reliability in our patients. As far as the potential hazards are concerned the growing experience in handling gases has recognized ways to anticipate and overcome most of these problems.

The most dreaded complication is the elevation of IOP to pathological levels. It is now known that whenever an expandable gas is injected two pressure peaks are recorded. First peak which is just after the injection is due to the sudden increase in vitreous volume. This subsides within minutes. The second peak occurs within hours. This peak is more sustained and is due to expansion of the gas.

As the gas expands the aqueous leaves the eye, thus giving it room. If the capacity of aqueous flow is lower than the rate of expansion of the gas, it results in marked elevation of intraocular pressure. As the rate of expansion of these gases is maximum in the first 6 hours[4,8-10] of injection, it is important to closely monitor the intraocular pressure during this period. In our department where we have enough doctors, special arrangement for monitoring IOP in the immediate postoperative hours was quite possible. In our study one patient developed IOP in the range of 30 mm Hg. This persisted even after absorption of the gas and may have been due to other reasons such as prolonged use of steroids, clogging of the trabecular meshwork by pigment and trabecular sclerosis.

Complication of endophthalmitis was avoided by meticulous suturing of ports, selecting proper air/gas mixture and maintaining strict intraoperative asepsis. There was only one case of intraopertive retinal incarceration at SRF drainage site. This occurred during SRF drainage and was successfully relieved by making the site dependent and separating the lips of the drainage site. None of the ports showed evidence of retinal incrceration in the immediate and late postoperative periods.

Besides such complications other reasons for avoiding the use of gas was a feeling that our patients may not maintain proper postoperative position. In this regard it was a nice experience to learn that our patients maintained any of the awkward positions they were asked to follow. This was made possible by strictly sticking to the selection criteria and counseling in the pre and postoperative periods.

In this study gas was used as an adjunct to other modalities and could not be used for pure pneumoretinopexy due to several reasons. Firstly, being the only vitrectomy unit in the government sector in Sindh we are confronted with the most complicated cases being referred from other centers. These cases with advanced PVR and with reattachment surgery already having been attempted in

a few, were not suitable for pure pneumoretinopexy. Secondly, we have an all or none sort of situation. Abroad there is a concept of minimal surgery for managing retinal detachment. They have no bar on attempting multiple surgeries if the simpler modalities fail. Here, due to lack of resources and due to the huge burden of patients, we are forced to offer the best effective combination of modalities in order to ensure a successful outcome.

Regarding the results with an average follow-up of ten months, anatomical attachment after the first operation was achieved in twenty-two eyes (78.5%), while in another two cases the retina was reattached on second attempt (Table-1). Final vision was better than 6/36 in seventeen cases (60.7%), while it was better than 3/60 in 22 eyes (78.5%) Table-2.

There was an improvement of vision from the preoperative level in 19 cases, while in the remaining 9 cases the vision either remained the same or there was detoriation from the preoperative level. These cases were the ones that developed vitreous hemorrhage, endophthalmitis and redetachment secondary to PVR. As regards postoperative complications (Table-3) the most frequently encountered complications were lens changes and temporary elevation of intraocular pressure. Lens changes were reversible in five of the seven cases. Mild PVR was also observed in seven cases. Redetachment was present in six cases, two of which were attached later.

Table-4 gives the anatomical success rates of Hilton, McAllister, Chen and Tornambe after the first and subsequent surgeries. They achieved anatomical success in 63-84% after the first surgery and in 99-100% after subsequent surgeries.

**Table-4: Representative Anatomical Results.**

| Author | Number of eyes | Reattached with initial procedures (%) | Rattached with later operations (%) |
|---|---|---|---|
| Hilton et al | 100 | 84 | 98 |
| McAllister et al | 56 | 71 | 100 |
| Chen et al | 51 | 63 | - |
| Tornambe et al | 103 | 73 | 99 |

## CONCLUSION

To conclude, gases are an essential tool in today's retinal surgeries. They can be combined with other modalities to improve the anatomical and visual outcome.

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# Prevention of Significant Visual Loss in Diabetic Macular Edema by Early Laser Photocoagulation

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## ABSTRACT

*Diabetic macular edema is an established cause of visual loss in both the insulin-dependent early onset and the noninsulin-dependent maturity onset diabetes mellitus.*

*A one-year prospective study was conducted at the diabetic clinic of Al-Shifa Eye Hospital, Rawalpindi, to study the incidence of diabetic macular edema in patients with mild to severe preproliferative diabetic retinopathy and to study the effects of laser treatment in the management of such cases in view of the various diabetic retinopathy treatment trials.*

*A total of 123 patients out of 537 examined in the clinic having clinically significant macular edema were included in the study. The ages of the patients included in the study ranged from 37 to 70 years with a duration of diabetes varying from 3 to 18 years. All patients included in the study had bilateral involvement making a total of 246 eyes. The incidence of macular edema in this study was 22.9%. Out of the 246 eyes subjected to laser treatment, either focal or grid, 16 (6.50%) showed improvement of a maximum of 2 lines from the baseline visual acuity. In 66 eyes (26.82%) there was no change in pre-laser visual acuity. There was a drop of one line in 88 eyes (35.8%), while 41 (16.7%) had a drop of two lines from the baseline level. 33 eyes (13.4%) had a drop of three lines or more. Thirty-seven patients (30.08%), i.e., 74 eyes had a progression of retinopathy and required panretinal photocoagulation.*

*This study shows a relatively high incidence of macular edema in preproliferative cases and confirms that early laser treatment should be considered for treatment of diabetic edema involving the macula or threatening the macula.*

## INTRODUCTION

Diabetes mellitus is fast becoming a global problem. It is estimated that over 100 million people representing six percent of adult population around the world suffer from this disease. According to the latest estimates by the International Diabetes Federation, by the year 2010 there will be a rise of 168 percent in diabetics in Asia, from 51.4 million to 138 million. Diabetic retinopathy is becoming an important cause of visual impairment in Pakistan. The prevalence of diabetes in Pakistan is estimated to be about 5-6%, i.e. approximately 6 million people of Pakistan are afflicted by this disease. The situation is further compounded by a low literacy rate, inadequate knowledge of the disorder and poor compliance. It is, therefore, mandatory to find out the prevalence of macular edema in diabetic population as well as to find out the best available management, not only to stop progression of the disease process but also to achieve visual rehabilitation.

Macular edema is considered the leading cause of decreased vision in patients with diabetic retinopathy. This study focuses on the management of diabetic macular edema in the light of various clinical trials.

## PATIENTS AND METHODS

A one-year prospective study was conducted in the Diabetic Eye Clinic of Al-Shifa Eye Hospital, Rawalpindi All consecutive new patients with mild to severe nonproliferative diabetic retinopathy having macular edema were screened for inclusion in the study. Out of these 537 patients, 123 had macular edema and were recruited in the study. Macular edema was defined as thickening of the retina within one disc

diameter of the center of the macula or the presence of obvious hard exudates in this region. The patients having proliferative diabetic retinopathy or hazy media due to corneal opacity or cataract were not included. Participants were examined at 3-month intervals according to the protocol of the study and underwent a complete physical and ophthalmoscopic examination, measurement of visual acuity, aided and unaided, fundus photography, fundus fluorescein angiography, measurement of glycosylated hemoglobin and blood pressure. Presence and degree of macular edema were assessed for areas within 500 $\mu$m of the fovea and for areas greater than 1 disc area involving the region within one disc diameter of the fovea and for central macular thickening.

The ETDRS photocoagulation protocol for macular edema was used (ETDRS report No.1).

This protocol specified both focal treatment of microaneurysms or other focal lesions that were believed to be causing retinal thickening or hard exudates. Grid laser treatments were used in areas of thickened retina in which there was diffuse fluorescein leakage or capillary loss.

Treatable lesions, like leaky microaneurysms, diffuse macular edema and areas of retinal thickening with or without ischemia were identified by fluorescein angiography. Focal laser photocoagulation was usually applied in a single episode. Grid laser was also performed in a single session. Mixed type of laser treatment was performed in two sessions and focal treatment was done earlier than the grid or panretinal photocoagulation (PRP). Argon blue-green laser was used in the study.

The size of laser burns in focal laser treatment used was 50-100 microns and 0.2 mW of energy, with 0.1 to 0.2 seconds duration, was directed to all microaneurysms up to 500 um of the center of the macula. If leakage persisted, focal treatment up to 300 um from the fovea was attempted. In diffuse macular edema, modified grid was performed. In the para-foveal area 100 um spot size was used, while in the remaining areas of diffuse macular edema 200 um laser spots were used.

The average number of spots ranged from 150-300, of 0.1-0.2 seconds duration and 0.1 to 0.2 mW power setting.

The follow-up visits were scheduled every three months. Visual acuity was measured, aided and unaided, and the patients were examined on the slit-lamp for measurement of intraocular pressure and any change in the anterior segment, like cataract. Patients were examined with 78 diopter and 90 diopter lenses after dilating the pupil with cyclopentolate 1% and isonephrine 2.5%. Assessment of retinal edema was done with the help of fundus photographs and FFA.

## RESULTS

The largest group of selected patients, i.e. 84 (68%), was between 50-60 years of age. The patients between 40-50 years were 15 (12.2%); patients above 60 years of age were also 15 (12.2%). Nine (7.3%) patients were below 40 years of age. Out of a total of 123 selected patients with macular edema, 69 (56.09%) had NIDDM, 49 (39.83%) had IDDM. 5(4.06%) of the patients were on no medical treatment for their diabetes.

Out of the selected 123 patients with macular edema, 66 (53.65%) patients had diabetes mellitus for more than 10 years, 42 (34.14%) for the last 5-10 years, and only 15 (12.2%) had diabetic history of less than 5 years. Out of 246 eyes, 60 eyes (24.39%) had focal leakage, and 105 eyes (42.68%) had clinically significant macular edema (CSME). Ischemia in macular or paramacular area was present in 33 eyes (13.4%) and diffuse macular edema was observed in 48 (19.51%) eyes.

Out of the selected 537 patients, 414 (77.09%) had nonproliferative diabetic retinopathy (NPDR) without macular edema, while 123 (22.91%) patients had macular edema. Incidence of macular edema in uncontrolled diabetes was 65.85%, while in controlled diabetics, this incidence decreased to 34.14%.

Out of 246 eyes, 16 (6.51%) eyes showed improvement of a maximum of two lines from the baseline visual acuity. In 66 (26.82%) eyes postlaser vision was the same as the prelaser vision. 88(35.77%) eyes showed one line less than the baseline visual acuity and 41(16.66%) had two lines loss. 33(13.42%) eyes showed 3 or more lines less than baseline visual acuity, while one patient was lost to follow-up. Stable retinopathy was observed in 85(69.1%) patients (170 eyes) at the end of one year. Progressive retinopathy was seen in 37 (30.08%) patients, (74 eyes) and all these patients required panretinal photocoagulation (PRP).

## DISCUSSION

Macular edema as a significant cause of visual loss in persons with diabetes was first recognized in 1973 by Patz and Schatz[1] as an overlooked complication of diabetic retinopathy. There are now at least five published randomized clinical trials of photocoagulation for diabetic macular edema that can be used as guidelines for patient management. Although the treatment protocols and patient selection varied in each study, the conclusions were the same, i.e., laser treatment tends to reduce the rate of visual loss in eyes with macular edema, but relatively few eyes show substantial visual improvement. The most frequently quoted studies of all are the Early Treatment Diabetic Retinopathy Study Group Reports (ETDRS)[2-4].

In the last decade, research has been concentrated on the effects of laser treatment on the progression and control of diabetic macular edema. We have found in our study that the eyes with macular edema that were assigned to laser treatment had a favorable outcome unless superimposed proliferative changes occurred.

The ETDRS divided the final visual acuity into three subgroups;

1. Group of patients having improved visual acuity.
2. Group of patients having no change in visual acuity.
3. Group of patients having loss of 3 or more lines from the baseline.

In our study the final visual acuity was divided into 5 groups.

1. Patients having improved visual acuity.
2. Patients having no change in visual acuity.
3. Patients having loss of maximum of one line from baseline visual acuity.
4. Patients having loss of maximum of two lines from baseline visual acuity.
5. Patients having loss of three or more lines from baseline visual acuity.

This study shows that 16, (6.5%) eyes had improved vision of up to two lines, in contrast to ETDRS group which showed 16% of eyes having improved vision of more than one line (ETDRS Report No. 2)[3].

OLK[5] reported 19 (45%) of his patients showing improved vision out of a total of 42, while Patz et al[1] claimed 17 (27%) of their patients having improved vision upto 2 lines out of a total of 63 eyes treated.

The vision in our study in (69.10%) of the eyes was better or remained relatively unchanged. In the ETDRS study with a follow-up of 2 years, 77% of the eyes after laser treatment remained unchanged, while the study by Olk showed a stabilization of vision in 45% of the cases as compared to the results of Patz showing 66% unchanged vision over a follow-up of 2 years. There was a loss of one line in 88 patients (35.77%), while 13.42% of the eyes lost three or more lines from baseline visual acuity; in ETDRS group this percentage decreased to 7% and Olk and Patz had a figure of 10% each.

We found 26.88% of eyes having the same visual acuity as prior to laser treatment, and 35.77 of eyes having one line less and 16.66% having two lines less from baseline visual acuity.

Comparing our results with other randomized clinical trials, our study shows 62.60% of eyes having no change or minimal change in visual acuity, while according to ETDRS the ratio of unchanged vision was 77%. Olk showed that 45% of his patients had unchanged vision, while Blankenship reported 60% of his patients with unchanged vision[6].

The prevalence of macular edema in our study was found to be 22.97%. This was the incidence occurring in mild to severe nonporliferative diabetic retinopathy (NPDR).

In ETDRS the prevalence of macular edema was 3-5% in mild NPDR and reported to be as high as 38% in moderate to severe NPDR. The prevalence of diabetic macular edema in NPDR as a whole was 20.6%. In our study this incidence is 22.97%, which is relatively high. The ETDRS also showed that worsening of diabetic retinopathy was associated with a greater risk of clinically significant macular edema. This percentage rises up to 71% in proliferative diabetic retinopathy.

We also found that laser photocoagulation treatment of macular edema may be less helpful in eyes with extreme capillary loss. Photocoagulation remains the principal treatment for diabetic macular edema. Findings of previous ETDRS analyses and those reported here support its application across a broad spectrum of retinopathy severity and support the concept that the most important factor to be

weighed in deciding whether and when to treat, is the degree to which the center of the macula is involved or threatened by retinal thickening and associated hard excudates.

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## *OSP News*

A Joint Meeting, the "21st Annual Congress of the Ophthalmological Society of Pakistan (C) and the 4th International Meeting, Islamabad Congress of Ophthalmology" is to be held from 11-13 September 1998, at the National Library of Pakistan, Islamabad. Exhibition of drugs and equipment has also been arranged.

Registration fee is Rs. 1500/- for senior ophthalmologists and Rs. 750/- for junior ophthalmologists. Foreign delegates: US $ 100/-.

For booking of stalls/advertisements in the Souvenir/Abstracts / Registration and for other information, please contact the Congress Secretary/President at: Congress Secretariat, No: 267-A, St: 53, F-10/4, P.O. Box: 1555, Islamabad. Phone: 051-299113 Fax: 051-299113 and 440361, 413991.

Case Report

# Acute Multifocal Placoid Pigment Epitheliopathy

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## ABSTRACT

*We report an eighteen-year-old young male who presented with clinical and angiographic findings consistent with acute multifocal placoid pigment epitheliopathy in addition to anterior uveitis.*

## INTRODUCTION

Acute posterior multifocal placoid pigment epitheliopathy (APMPPE) is a term first used by Gass in 1986[1]. APMPPE is an idiopathic posterior segment inflammatory disorder of young, otherwise healthy, adults. The pathophysiology of APMPPE is poorly understood and debate persists as to whether it represents primary pigment epithelial disorder or a choroidal vascular disease. APMPPE is commonly believed to be a benign disease with excellent visual prognosis but long-term visual prognosis and recurrence rate are uncertain. APMPPE is generally self- limiting and there is currently no treatment that has been proven effective.

## CASE REPORT

An eighteen-year-old young male was referred to the Department of Ophthalmology, Unit-I at the Services Hospital, Lahore, from the District Hospital, Sahiwal.

He presented with rapid, painless deterioration of vision in both eyes during the previous two weeks. The visual loss was associated with prodromal 'flu-like symptoms.

Past history regarding any ocular or systemic illness was insignificant.

At the time of presentation, the patient was on oral steroids (Tab Decadron 10 mg per day) in addition to a multivitamin tablet.

His corrected visual acuity was 6/60 and 6/18 in the right and the left eyes, respectively. Intraocular pressure was 14mm of Hg in each eye. Slit-lamp examination revealed anterior uveitis. Fundus examination revealed multiple creamy or yellow-white placoid lesions scattered over the posterior pole at the level of the pigment epithelium. The lesions were well-circumscribed and discrete, except for a few confluent patches. Macular involvement was more on the right than on the left side. Rest of the retina appeared normal. Fluorescein angiography demonstrated hypofluorescent areas corresponding to the patterns of acute lesions in the early frames of the angiogram. In the later frames, the lesions showed hyperfluorescence.

## DISCUSSION

APMPPE is a chorioretinal disease that causes acute visual symptoms with characteristic fundus findings.

The pathogenesis of APMPPE remains obscure. Indocyanine green angiography has been used to study choroidal blood flow. In one study, indocyanine green angiogram of APMPPE showed areas of hypofluorescence in both the early and late pictures that correlated with the placoid lesions. Image analysis identified these as areas of choroidal hypoperfusion[2]. In another study, multiple placoid lesions observed in the early phase of indocyanine green video angiography showed hypofluorescent lesions corresponding to those seen with fluorescein angiography which blocked choroidal vessels[3].

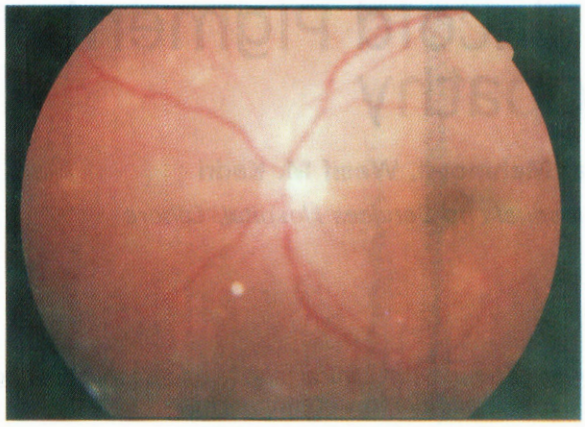

Figure 1:
Fundus photograph of the left eye with a few isolated APMPPE lesions.

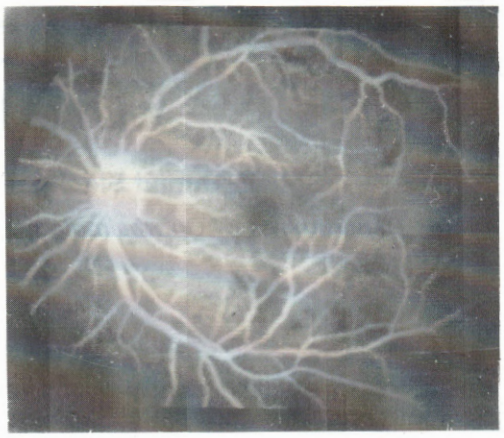

Figure 3:
Early angiogram with blockage of fluorescence (hypofluorescence) corresponding to the exact pattern of the acute lesions.

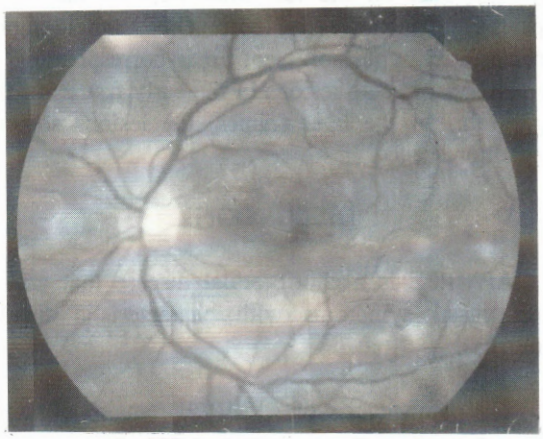

Figure 2:
Red-free fundus photograph of the same left eye with multiple patches of APMPPE.

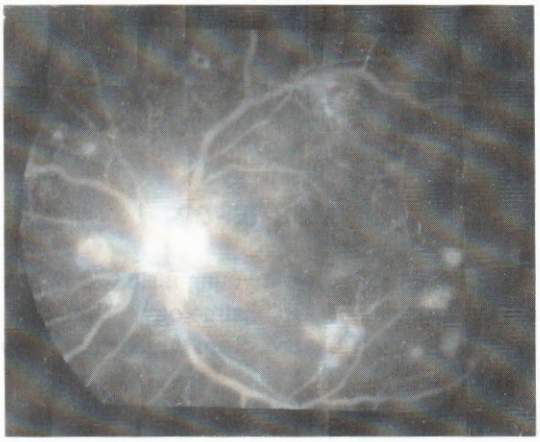

Figure 4:
Late angiogram with hyperfluorescence of the same lesions.

A profound delay in choroidal filling and extensive areas of choroidal vessel nonperfusion in the acute stage of the disease were also demonstrated by other authors[4]. Regarding the pathogenesis of APMPPE, there is increasing evidence in favour of a primary vascular disorder of the precapillary choroidal arterioles that causes ischemic edema of the overlying retinal pigment epithelium secondarily[5].

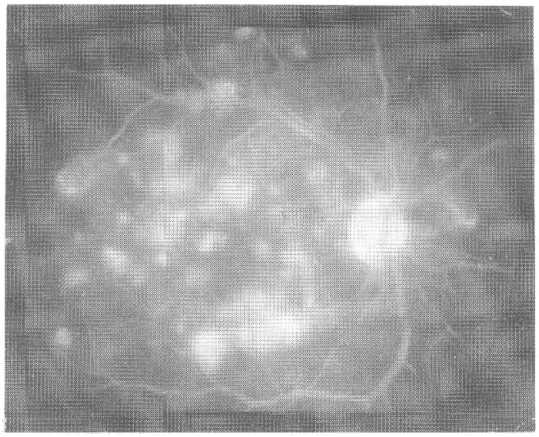

**Figure 5:**
**Late staining is evident in this angiogram of the right eye.**

The cause of APMPPE is unknown, although it frequently follows a 'flu-like illness. An increased prevalence of HLA-B7 and HLA-DR2 antigens in patients with APMPPE suggests an immunogenic predisposition to acquire this disease[6].

APMPPE has been associated with a variety of neurological complications and it should be considered among the causes of stroke and aseptic meningitis in young adults[7].

Central diabetes insipidus has been associated with APMPPE with an immunogenic predisposition[8].

Hepatitis B virus immunization may be a risk factor for APMPPE. These cases suggest an immune-mediated retinal pigment epithelium disruption or choroidal vascular occlusion triggered by hepatitis B surface antigen[9].

Ocular manifestations of APMPPE include episcleritis[10], granulomatous anterior uveitis[11], retinal vasculitis and serous retinal detachment[12].

Caution should be exercised in offering a prognosis in cases with the following atypical features: age older than 60 years, unilaterality, an interval before involvement of the second eye of at least six months, recurrence of the disease and leakage from choroidal veins[13].

APMPPE has a good long-term prognosis for visual acuity, although most patients have residual symptoms like central and paracentral scotomas, metamorphopsia, decreased vision, floaters and chronic redness[14,15].

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## *Ophthalmic "Pastpourri"*

# Keratoplasty
## The Fundamental Principles

In June of 1906, more than six months after the world's first successful human corneal allograft operation, by Zirm, the eye was essentially the same--a clear graft sharply differentiated from the surrounding opaque cornea by a tendinous-looking ring. The patient was able to get about by himself quite well and even to perform such work as feeding and attending to cattle.

On the 14th of December 1906, Zirm presented his patient before the Vienna Medical Society. He reviewed his case, paid tribute to the work of Sellerbeck and von Hippel, and then went on to list six essential points for success in keratoplasty:

1. The exclusive employment of human cornea for the graft; if possible youthful cornea, whose nutritive condition is favorable.
2. The exclusive employment of von Hippel's trephine and the instillation of eserine if the anterior chamber is present.
3. Deep anesthesia, strict asepsis, and the avoidance of antiseptics.
4. The protection of the graft, until it can be placed in position, between two pieces of gauze moistened with sterile physiological salt solution and kept warm with steam.
5. The holding of the graft in its place by two threads drawn through the conjunctiva and forming a cross in front of it.
6. The careful selection of cases.

Excerpted from: Alois Glogar, Karl Brauer, and Eduard Konrad Zirm. In: Our Ophthalmic Heritage by Charles Snyder. Little, Brown and Company, Boston. 1967; pp 107-8.

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# Capsulotomy Vectus: A new Way to Perform Capsulotomy

**Saeed Mukhtar**

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## ABSTRACT

*A new instrument is discussed that can help cut the anterior capsule during cataract surgery, more easily and more precisely than any other type of capsulotomy instrument.*

*The results have been studied in about eighty cases undergoing various cataract extraction procedures.*

## INTRODUCTION

Continuous curvilinear capsulorhexis or can-opener type of techniques are used by many, but I have developed a new technique in which a circular sharp blade cuts the anterior capsule into precise dimensions.

I got the idea that if a circular blade is made to rotate on the anterior capsule, then a precisely cut opening can be made through which any kind of cataract extraction can be done. With such an instrument two major problems can occur.

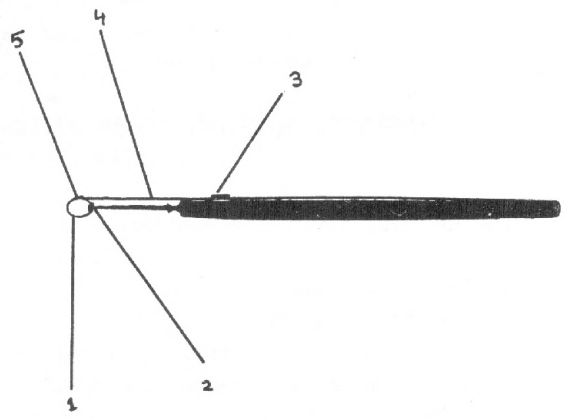
i. Irregularly or incompletely cut capsule.
ii. Pull on the suspensory ligaments which can dislocate the lens.

The first problem was solved by making a sharp, precisely engineered circular blade. The second problem was more challenging as the movement of the instrument containing the blade can dislocate the lens and thus the blade cannot be made effective by moving the instrument.

According to the `torque' principle of physics, a circular blade will cause minimal possible peripheral pull if it is made to rotate on its axis while the major instrument remains stationary. Thus a mechanism was designed which fulfills this criterion. Pull on the capsular bag is further minimized by the fact that the blade is sharp throughout the circumference and thus only a rotation of one millimeter or less is enough to complete the capsulotomy.

## METHOD

The use of this "capsulotomy vectus" is very simple. Introduce it through the incision and put the blade on the anterior capsule delicately but firmly.




**Capsulotomy Vectus**
**(The design of the capsulotomy vectus is registered and patented. [Reg. No. 04912])**

1. Circular Blade
   Height = 1.25mm
   Diameter = 3mm to 5mm.
2. Flexible support of the blade.
3. Push button.
4. Metal wire which moves the blade
5. Wire's fixation with the blade.

With the slight movement of the button in the shaft of the handle the circular blade will move (or rotate) for about one millimeter.

Now remove the instrument and pick the cut piece of the anterior capsule with the help of a capsular forceps. A circular, precisely controlled capsulotomy is completed.

I have developed the blades of various diameters so that capsulotomy of any required size can be made.

## RESULTS

Capsulotomy vectus was used during thirty cases of phacoemulsification, forty-two cases of standard ECCE and seven cases of manual small incision cataract surgery. The results were as good as with capsulorhexis or can-opener type capsulotomy.

No capsular tags or anterior capsular tears were seen. Results were found to be equally good in three hypermature and four calcified cataracts.

## COMPLICATIONS

The use of this instrument is highly viscoelastic-dependent as its blade has got a certain height (1.2mm) and thus it can cause damage to the corneal endothelium.

The introduction of this instrument through the wound is also a delicate step. It is found to be safer to use it through a scleral incision, as it can cause damage to the cornea at the site of introduction.

## DISCUSSION

There were several steps in the manufacture of the prototype I am using. Now the next problem is the commercial availability of the instrument, which requires a lot of financial expenditure. But I am hopeful that it will be available in Pakistan during the next six to eight months for a price around Rs. 500.00.

In this instrument the mechanism to move the blade along its axis is the push of a metal wire through a push button. I am improving the design of the instrument in which a ball bearing mounted blade will be made to move more precisely and smoothly.

## COMPARISON BETWEEN MUKHTAR'S CAPSULOTOMY VECTUS-CAPSULOTOMY & OTHER TYPES OF CAPSULOTOMIES

**Capsulotomy Vectus-Capsulotomy**

1. The Technique is very simple. No special training is required.
2. Capsulotomy can be precisely controlled
3. No capsular tags are seen after capsulotomy. Capsular edges are circular and uniform.
4. Any size capsulotomy can be performed.
5. Capsulotomy can be done in mature, hypermature, calcified or milky cataracts.
6. Endocapsular technique of phacoemulsification can be performed with this type of capsulotomy.
7. All types of ECCE can be performed with this type of capsulotomy.

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**Other Capsulotomies**

1. All other techniques of capsulotomy require a period of practice and learning.
2. Capsulotomy is difficult to control even in experienced hands.
3. Capsular tags may form which have to be cut.
4. Capsular edges are usually irregular even in capsulorhexis.
5. Only experienced surgeons can control the size of the capsular opening.
6. In such cases mostly it is difficult to perform capsulotomy and sometimes the surgeon has to convert to intracapsular extraction.
7. Only continuous curvilinear capsulorhexis can be useful in endocapsular phacoemulsification which is difficult to learn.
8. Different types of capsulotomy may be required for different procedures.

# Phacoemulsification: A Comparative Analysis of the First Hundred and the Subsequent One Fifty Cases

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## ABSTRACT

*A comparative analysis of two series of cases of phacoemulsification is presented: the first one hundred and the subsequent one hundred and fifty cases. There is a clear reduction in the incidence of both serious and minor complications with improvement in technique and more experience. Some of the complications, like severe postoperative uveitis, and iris damage encountered in the first series, were virtually absent in the subsequent series. With improvement in skill one can manage harder nuclei without increasing the rate of serious complications.*

## INTRODUCTION

While extracapsular cataract extraction with posterior chamber lens implant is still the most popular form of cataract surgery in our country, undoubtedly with excellent results, more and more of eye surgeons are shifting to phacoemulsification as the preferred form of cataract surgery because of the added benefits of less astigmatism and quick visual and physical rehabilitation[1-4]. Unlike the shift from intracapsular cataract extraction (ICCE) to extracapsular cataract extraction (ECCE), this shift is slower and faces more reluctance because of costlier equipment and relatively difficult learning curve. But once mastered, it is a rewarding procedure. In this article the authors present an analysis of their experience with the first one hundred and the subsequent one hundred and fifty cases of phacoemulsification.

## MATERIALS AND METHODS

The patients included in the study were operated on at the Institute of Ophthalmology, King Edward Medical College, Lahore, during a period extending from January 1996 to December 1997. Out of 250 cases, 36(14.4%) were without IOL implantation, while 214(85.6%) had either PMMA 5.0 to 5.5mm optic posterior chamber IOL (206 cases, 82.4%) or foldable silicone plate haptic posterior chamber implants, (8 cases, 3.2%) (Tables 1-3). The surgery was performed with the Storz Protege phacoemulsification machine with venturi pump. A 3.2mm clear corneal tunnel incision was used for phacoemulsification. It was enlarged later to 5.2 to 5.5mm where PMMA 5-5.5mm optic posterior chamber IOL was implanted. Continuous curvilinear capsulorhexis (CCC) was performed with a bent 26 gauge needle through a separate incision made on the right side of the main incision after injection of 2% methylcellulose into the anterior chamber. After hydrodissection and hydrodelineation, endocapsular phacoemulsification and aspiration of nucleus was carried out. Residual cortical matter was aspirated using a manual Simcoe cannula. Either a foldable silicone plate haptic posterior chamber lens implant was injected in-the-bag using a special injector, or the original 3.2mm incision was enlarged to 5.2-5.5mm and 5-5.5mm optic single-piece PMMA posterior chamber lens was implanted in-the-bag. In all cases no sutures were used as the incision was a self-sealing valve-type one.

After discharge from the hospital the patients were followed at 1,2,4,6 and 8 weeks. At each postoperative visit, in addition to the routine follow-up, unaided visual acuity and keratometry readings to assess the amount of astigmatism, were recorded. Refraction was done 8 weeks postoperatively.

## RESULTS

Out of the first one hundred patients, 67 had IOL implantation and among these patients 39 (58%) achieved uncorrected visual acuity between 6/6 and 6/12, while 12 patients (18%) had 6/18 and 16(24%)

had uncorrected visual acuity less than 6/18 (Table-4). Amongst the subsequent 150 cases, 147 had PCIOL implantation and amongst these, 76 patients (51.7%) achieved uncorrected 6/6-6/12 vision, 45 patients (30.6%) had 6/18 and only 26 patients (17.7%) had uncorrected vision of less than 6/18.

Postoperative astigmatism ranged between 0.0D and a maximum of 2.0 D. None of the patients with foldable IOLs had astigmatism greater than 1.0 D. Phacoemulsification time ranged between 45 seconds and 8.29 minutes with an average of 4.28 minutes.

**Table 1: Review of 250 cases.**

| | First 100 | Next 150 |
|---|---|---|
| **Without IOL** | 33 | 03 |
| Total 36 | | |
| **With IOL** | 67 | 147 |
| Total 214 | | |
| (a) PMMA 5-5.5mm IOL | 62 | 144 |
| (b) Foldable Silicone IOL | 05 | 03 |

**Table 2: Comparison of preoperative visual acuity.**

| V.A | First 100 | Next 150 |
|---|---|---|
| PL-HM | 07 (7%) | 04 (2.7%) |
| CF | 52 (52%) | 72 (48.0%) |
| 6/24-6/12 | 41 (41%) | 74 (49.3%) |

**Table 3: Comparison of nuclear grading.**

| | First 100 | Subsequent 150 |
|---|---|---|
| I | 01 | 06 |
| II | 55 | 29 |
| III | 40 | 94 |
| IV | 04 | 21 |
| **Total** | **100** | **150** |

**Table 4: Comparison of postoperative uncorrected visual acuity in IOL patients.**

| Visual acuity | First 100 (67 IOL patients) | Next 150 (147 IOL patients) |
|---|---|---|
| 6/6-6/12 | 39 (58%) | 76 (51.7%) |
| 6/18 | 12 (18%) | 45 (30.6%) |
| < 6/18 | 16 (24%) | 26 (17.7%) |

## COMPLICATIONS

The commonest postoperative complication was corneal edema with an incidence of 15 cases (15%) in the first 100 cases. In the later 150 patients only 2 patients (1.3%) had excessive striate keratopathy which cleared within a few days without any serious consequences (Table-5).

**Table 5: Comparative analysis of complications in the first 100 and the next 150 cases (percentages).**

| Complication | First 100 | Subsequent 150 | Total 250 |
|---|---|---|---|
| Striate keratopathy | 1.5 | 1.3 | 6.8 |
| Uveitis | 8.0 | 4.0 | 5.6 |
| P.C. rent | 7.0 | 2.6 | 4.4 |
| Loss of nucleus into vitreous | 1.0 | 1.3 | 1.2 |
| Zonular dehiscence | 1.0 | 0.0 | 0.4 |
| Ptosis with ophthalmoplegia | 1.0 | 0.0 | 0.4 |
| Collapsed A.C. | 1.0 | 0.0 | 0.4 |
| Iris damage | 1.0 | 0.0 | 0.4 |

In the first 100 cases 7 patients (7%) had posterior capsular (PC) rent. This was reduced to 4 patients (2.6%) in the next 150 cases. Out of these 4 patients 2 had minor PC rent and PCIOL was successfully implanted, while in the other 2 patients the nucleus was lost in the vitreous and required pars plana vitrectomy subsequently.

Other complications encountered in the first 100 patients included excessive postoperative uveitis (8%), iris damage (2%) and zonular dehiscence (1%). But none of the next 150 had these complications.

## DISCUSSION

A comparative analysis of two series of cases, the first 100 and the next 150 cases operated on over the span of about two years shows the initial difficulties encountered while learning to master this relatively new technique. A look at preoperative visual acuity and nucleus grading will make it obvious that one tends to operate on eyes with relatively better preoperative vision and harder nuclei with advancement in skill. It shows the surgeon's increasing confidence that better visual acuity can be achieved postoperatively and relatively harder nuclei can also be dealt with by phacoemulsification without any additional risk. There is no doubt that initially the rate of complications is definitely higher than with ECCE performed with the conventional technique. This is always true when one tries to learn newer techniques. The relatively higher rates of postoperative corneal edema in the first series of cases may be due to the reason that initially in some of the cases phacoemulsification was performed in the anterior chamber (AC) because the nucleus was dislodged into the AC, which resulted in more damage to the corneal endothelium. In the first 100 cases, the authors used to make relatively larger corneal tunnels (3-4mm), while in the later cases this size was reduced to 1-2mm which helped to reduce postoperative edema. Moreover, liberal use of viscoelastics also helped to reduce the incidence of this complication to much lower levels. It was noted that a higher incidence of PC rent in the first series resulted from poorly done CCC with extension of the tear to the posterior capsule. With improvement in performing CCC, this problem was solved. In the initial cases poor coordination between flow rate and aspiration resulted in a sudden buildup of pressure and a few inadvertent PC ruptures, but with more experience this was no longer a problem. Phacoemulsification, although more demanding, both equipment-and technical skill-wise, is really rewarding, because of earlier visual rehabilitation and less postoperative astigmatism. With closed chamber and controlled fluid dynamics, there is also less chance of damage to the precious corneal endotherlium[5]. The risk of serious complications, like posterior capsular rupture, is real, but with more experience and skill this will be reduced to the minimum. If such complication occurs prompt recognition and proper management will give the patient vision not far inferior to that expected otherwise.

## CONCLUSION

As expectations of the patients undergoing cataract surgery grow and rival those of refractive surgery patients, with more experience and better skill, phacoemulsification can safely bring the benefits of small incision cataract surgery to these patients. While converting to phacoemulsification from conventional ECCE may be a more uphill task, it also provides some real benefits for the patients.

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# Orbital Lesions in Children

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## ABSTRACT

*The authors present an analysis of their experience with 110 cases of orbital lesions in children. Orbital tumors were the most common (60 cases, 54.5%) orbital lesions and retinoblastoma was the commonest (33 cases 55%) among the orbital and ocular tumors in children. Other common tumors were optic nerve glioma (11 cases, 18.3%) and vascular tumors (6 cases, 10%). Many of these cases presented very late and were referred from different centers from across the province of Punjab. These advanced cases required drastic measures, like exenteration followed by radiotherapy and chemotherapy. Those presenting earlier were treated with orbitotomy from different approaches and were followed by radiotherapy if required.*

## ORBITAL LESIONS IN CHILDREN

Orbit is a closed cavity with compact arrangement of different tissues derived from all three germinal layers. A wide variety of pathological processes and space-occupying lesions can be seen in any age, sex and race[1].

Pragmatically, proptosis in children is managed differently than in adults, since often it is necessary to intervene rapidly in children. Children are more likely to have either a rapidly growing malignant orbital tumor or contiguous spread of the infectious sinusitis. Either can result in blindness or loss of eye if not treated rapidly[2].

The study was conducted at the Institute of Ophthalmology, Mayo Hospital, Lahore. A total of 110 cases of orbital lesions in children were analyzed. They were classified as neoplastic, inflammatory, hemopoietic reticuloendothelial system (RES) lesions, traumatic, cystic and congenital. Every patient went through a standard protocol of detailed history, general physical evaluation, examination of eyes, orbits and sinuses. Special diagnostic procedures used were exopthalmometry, radiological studies, angiography, ultrasonography (B-Scan), CT scan and MRI. Excision biopsy was done where indicated.

## RESULTS

Analysis of 110 cases of orbital lesions in children revealed that orbital tumors were the most common orbital lesions (60 cases, 54.5%), followed by inflammatory (21 cases 19.1%), hemopoietic RES lesions (11 cases, 10%), traumatic, cystic and congenital lesions (6 cases, 5.5%) each (Table-1).

Retinoblastoma was the commonest ocular and orbital tumor (33 cases, 55%) (Table-2). Optic nerve tumors (all gliomas) were seen in (11 cases, 18.3%) of tumors. Vascular tumors comprised 10% of all tumors (16 cases). Among the vascular tumors fibrocystic hemangiopericytomas were 33.3%. capillary angiomas 33.3% and lymphangiomas were 33.3%, i.e. 2 cases each (Table-3).

Muscular tissue tumors (all rhabdomyosarcomas), were seen in (6 cases, 10%). Fibrous tissue tumors (connective tissue nodular tumors) were seen in 2 patients or 3.3% of all tumor cases.

Hemopoietic reticuloendothelial system tumors were seen in 11 cases or 10% of the orbital lesions in children. Among these, 7 cases (64%) were leukemias and 4 (36%) were lymphomas (Table-4).

Cystic lesions were seen in 6 patients, i.e 5.4% of the orbital lesions. Among the cystic lesions, dermoid inflammatory and hematic cysts had an equal incidence of 33% each i.e. 2 cases each (Table-5).

Congenital lesions seen in 6 cases comprised 5.4% of the total orbital lesions. Among these, meningoceles and encephaloceles had an equal incidence of 50% (3 cases) each (Table-4).

## DISCUSSION

110 children up to the age of 12 years were investigated. Children with orbital lesions comprised 2.5% of the total number of patients admitted in the Institute of Ophthalmology and 40% of the total orbital lesions (adults and children). Most of the cases included in the study had been referred from different parts of the province and presented very late when there was gross deformity or deterioration of vision due to extension of the lesion into the orbit and involvement of the optic nerve.

Table 1: Orbital Lesions.

| Orbital Lesions | No. of cases | Percentage |
|---|---|---|
| Neoplastic | 60 | 54.5 |
| Inflammatory | 21 | 19.1 |
| Hemopoietic/ Reticuloendothelial | 11 | 10.0 |
| Traumatic | 6 | 5.5 |
| Cystic | 6 | 5.5 |
| Congenital | 6 | 5.5 |

Table 2: Orbital tumors

| | No. of cases | Orbital Lesions (Percentage) | Orbital tumors (Percentage) |
|---|---|---|---|
| 1. Retinoblastoma | 33 | 30.0 | 55.0 |
| 2. Tumors of optic nerve | 11 | 10.0 | 18.3 |
| 3. Vascular tissue tumor | 6 | 5.4 | 10.0 |
| 4. Muscular tissue tumor | 6 | 5.4 | 10.0 |
| 5. Nervous tissue tumor | 2 | 1.8 | 3.3 |
| 6. Fibrous tissue tumor | 2 | 1.8 | 3.3 |

Table 3: Vascular tumors.

| | Number of cases | %age of orbital lesions | %age of orbital tumors | %age of vascular tumors |
|---|---|---|---|---|
| 1. Fibrocystic hemangio-pericytoma | 2 | 1.8 | 3.3 | 33.3 |
| 2. Capillary angioma | 2 | 1.8 | 3.3 | 33.3 |
| 3. Lymphangioma | 2 | 1.8 | 3.3 | 33.3 |

Table 4: Hemotopoietic reticuloendothelial system lesions.

| | Number of Cases | Percentage of Total Orbital Lesions | Percentage of Hemat/Retic Lesions |
|---|---|---|---|
| Leukemia | 7 | 5.8 | 60.0 |
| Lymphoma | 4 | 3.9 | 40.0 |

Table 5: Cystic lesions.

| | Number of Cases | Percentage of Total Orbital Lesions | Percentage of Cystic Lesions |
|---|---|---|---|
| 1. Dermoid | 2 | 1.9 | 33.3 |
| 2. Inflammatory | 2 | 1.9 | 33.3 |
| 3. Hematic | 2 | 1.9 | 33.3 |

Table 6: Congenital lesions.

| | Number of Cases | Percentage of Total Orbital Lesions | Percentage of Cong. Lesions |
|---|---|---|---|
| 1. Meningocele | 3 | 1.9 | 50.0 |
| 2. Encephalocele | 3 | 1.9 | 50.0 |

Orbital tumors were the major cause of displacement of the eyeball. Among the orbital tumors, the incidence of retinoblastoma is very high. It is the most common ocular tumor of children and is responsible for approximately 5% of blindness in children and 1% of death in infancy[3]. It is also the most common ocular and orbital tumor in Pakistan[4]. Average age at presentation mentioned in the literature is 18 months[5]. In our study the age ranged from 18 months to 10 years. Bilateral involvement was seen in 20% of cases. The mode of presentation depended on the stage at the time of presentation. It was leukocoria when seen at an early stage. A fungating mass protruding between the eyelids or the secondaries to the regional lymph nodes and skull were seen in

advanced stages. Treatment varies according to the stage of the disease. Those who presented with the involvement of the optic nerve and displacement of the eyeball had enucleation followed by radiotherapy. Exenteration was done in all those cases where tumors had invaded the orbit or where recurrence occurred. In all these cases exenteration was followed by radiotherapy, chemotherapy, or both.

Optic nerve tumors in our study were gliomas only. Comparison with other workers on orbital tumors showed that in their series gliomas were 80% and meningiomas 20%[6,7]. Clinical presentation was firstly, a loss of vision and then displacement of the eyeball. To start with, the displacement is axial but later on it may progress in any direction. In early cases no mass is palpable but ultrasonography (USG) can detect space-occupying lesions. Later on the mass becomes palpable. Treatment is surgical--usually lateral orbitotomy provides good approach to the site of the lesion. Postoperatively, though, the patient suffers a loss of vision, but improves cosmetically.

Vascular tumors in children are more compressible than those in adults, as connective tissue capsule does not develop till later in life[8]. The tumor is usually located in the muscular funnel and almost invariably manifests itself temporally as a mass, eventually becoming palpable through the upper or lower eyelid[9]. Displacement of the eyeball is the major presentation along with a palpable mass in the orbit. Treatment of these lesions is surgical and in case of hemangiopericytoma it is followed by radiotherapy. No apparent feeding vessel is seen at the time of surgery.

Rhabdomyosarcoma is the third most common tumor of childhood, after leukemia and neuroblastoma[10]. These cases present with rapid displacement of the eyeball, conjunctival chemosis, restricted ocular movements, and a palpable mass in the orbit. Treatment is excision followed by radiation or exenteration followed by radiation.

Lesions of neurofibromatosis present with typical S-shape enlargement and atrophy of the upper lid with displacement of the eyeball. Characteristic clinical feature is the enlargement of the orbit. Treatment is difficult and noneffective[1]. These cases presented with progressive diffuse thickening and hypertrophy of the eyelid and displacement of the eyeball. Cafe-au-lait spots could be seen on the backs of these patients. Radiological studies showed typical enlargement of the affected orbit. Treatment of these cases is difficult, treacherous, and frustrating. It was explained to the patients that cosmetic results would be temporary and unsatisfactory, hence no surgical intervention was done.

Fibrous tissue tumors were few in number. Fibroma was the most common tumor amongst the fibrous tissue tumors of the orbit. This was characterized by a slow, non-infiltrating mass in the orbit. Treatment is excision.

Acute inflammatory lesions of the orbit are the most common cause (after retinoblastoma) of displacement of eyeballs in children. These cases mostly present with the history of fever with or without some upper respiratory tract infections, sinusitis (ethmoiditis in children), proptosis, conjunctival chemosis and restricted ocular movements. In most of these cases a mass is palpable in the orbit. These lesions are treated with systemic antibiotics and anti-inflammatory agents. If medical treatment fails and clinical picture does not improve and abscess appears on the surface, it is drained. If pockets of pus are deep-seated, orbitotomy is required.

Hematopoietic RES tumors (11 cases) comprised 10% of the orbital lesions. Seven cases (64%) of these lesions were leukemias and 4 cases (36%) were lymphomas. These lesions may be primary in the orbit or appear as manifestations of generalized disease. Patient usually seeks advice not because of symptoms but due to fullness or mass in the upper lid with displacement of the eyeball. In 60% of cases there is bilateral involvement. These tumors are highly radiosensitive. Patients of leukemia were exposed to radiotherapy, chemotherapy, or both. In cases of lymphomas in which the disease was limited only to the orbit, the mass was removed surgically, followed by radiotherapy. Patients in whom orbital lesions were manifestations of generalized disease, radiotherapy was combined with chemotherapy.

Traumatic lesions also behaved like tumors. Displacement of the eyeball was due to organized hematoma in the orbit. The resulting proptosis may not directly relate to trauma and some time may elapse between the trauma and the onset of displacement of the eyeball. Diagnosis is confirmed by history, examination, ultrasonography and exploration. Treatment is surgical. Patients with orbital cysts present with displacement of the eyeball with a palpable mass in the orbit. Ultrasonography is helpful in the diagnosis of these cystic lesions. Treatment is surgical.

Congenital lesions were due to faulty closure of the fetal fissures permitting cranio-orbital herniatation resulting in displacement of the eyeball. These lesions often require collaborative surgery with a neurosurgeon.

## CONCLUSION

A wide variety of orbital lesions can occur in children who mainly present with proptosis. In most of these cases the underlying cause is a neoplasm which may be vision-and life-threatening. Orbital lesions in children often require early intervention. Orbital ultrasonography and CT scan are very helpful in assessing the nature and site of the lesion. At times collaborate surgery with ENT surgeons and neurosurgeons is also required.

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# Abstracts

**Edited by Ajmal Nisar**

### Evaluation of Endothelial Cell Changes 1 Year After Excimer Laser In Situ Keratomileusis

***Perez-Santonja JJ, Sakla HF, Alio JL.***
***Arch Ophthalmol 1997; 115: 841-6.***

The purpose of this study was to investigate changes in the human corneal endothelium after excimer laser in situ keratomileusis for the correction of high myopia.

Preoperative and serial postoperative specular microscopy of the central corneal endothelium was performed on 31 patients (45 eyes)(group A) who underwent laser in situ keratomileusis for the correction of myopia ranging from -8.25 to -18.50 diopters. Twenty-one patients (30 eyes) were contact lens wearers (group B ), and 10 patients (15 eyes) had never worn contact lenses (group C). The central endothelium was analyzed for cell density, coefficient of variation in cell size, and hexagonality. The preoperative data were compared with those obtained 3,6, and 12 months after surgery in all groups.

In group A, the postoperative mean cell density increased significantly (2.3%) at 6-month follow-up (P=.04); the coefficient of variation decreased at all follow-ups (P<.001); and the percentage of hexagonal cells increased at all follow-ups (P<.05). In group B, there was a significant postoperative increase in cell density at the 3- (2.36%) and 6-month (3.74%) follow-ups (P<.05); the coefficient of variation decreased at ll follow-ups (P<.001); and the hexagonality was also significantly higher at all follow-ups than it was before treatment (P<.05). In group C, no significant differences in mean cell density or morphometric indexes were found between preoperative and postoperative values.

In conclusion, laser in situ keratomileusis caused no damage to the central corneal endothelium. The postoperative improvements in endothelial cell density and morphometric indexes are related to postoperative discontinuation of contact lens use.

### Effect of Timolol on the Diurnal Intraocular Pressure in Exfoliation and Primary Open-angle Glaucoma

***Konstas AGP, Mantziris DA, Cate EA, Stewart WC***
***Arch Ophthalmol 1997; 115: 975-9.***

The purpose of this study was to describe and compare the diurnal intraocular pressure (IOP) variation in patients with exfoliation glaucoma (EXG) and primary open-angle glaucoma (POAG) who were treated with a solution of timolol maleate (0.5%) twice daily.

Consecutive Greek patients who were newly diagnosed as having EXG or POAG were prospectively investigated; they underwent 24-hour diurnal IOP measurements first without therapy and then 6 months afterward while they were being treated with timolol maleate (0.5%). After matching for age, 38 pairs of patients with these 2 types of glaucoma were compared.

Untreated patients with EXG had significantly higher IOP values for all time points assessed and a greater mean range of IOPs (11.8mm Hg for EXG vs 7.6 mm Hg for POAG; P<.001). Following therapy with timolol maleate (0.5%) given twice daily, patients with EXG had higher IOP values for the measurements that were obtained at 6 and 10 AM, 10 PM, and 2 AM, a higher mean range of IOPs (7.0 mm Hg for EXG vs 5.6mm Hg for POAG;p=.03), and a higher maximum IOP (mean, 24.9 mm Hg for EXG vs 20.9 mm Hg for POAG;P=.003). The reduction of the range of diurnal variation of IOP was more pronounced in patients with EXG than in patients with POAG (40% vs 26%;P=.04). Twenty-two (58%) of 38 patients with EXG and 20 (53%) of 38 patients with POAG had peak IOP values that were found outside office hours. Only 5 (13%) of the patients with EXG exhibited an IOP of 18 mm Hg or less at all time points compared with 12 (32%) of the patients with POAG (P=.05).

In conclusion, despite a greater initial IOP reduction in the patients with EXG treated with timolol, a higher IOP and significant fluctuation in the diurnal curve of IOP during the time in which patients received therapy still characterized EXG from POAG.

### Do Intact Viral Particles Survive Excimer Laser Ablation?

***Taravella MJ, Weinberg A, Blackburn P, May M.***
***Arch Ophthalmol 1997; 115; 1028-30.***

The purpose of this study was to determine if intact and potentially infectious viral particles can withstand excimer laser ablation and possibly pose a health hazard to medical personnel.

Excimer laser ablation of fibroblasts infected with attenuated varicella-zoster virus was performed. The laser plume was collected for polymerase chain reaction analysis and viral culture.

While viral DNA was detected in the material trapped from the laser plume, live virus could not be demonstrated to have survived ablation.

It was concluded that attenuated varicella-zoster virus does not seem to survive excimer laser ablation. However, the authors recommend the use of safety precautions such as wearing a mask during the procedure. Further research is necessary to determine if other viruses could possibly remain infectious despite exposure to excimer laser radiation.

**Cigarette Smoking and the Risk of Development of Lens Opacities**
*The Framingham Studies.*
***Hiller R, Sperduto RD, Podgor MJ, Wilson PWF, Ferris FL III, Colton T, D'Agostino RB, Roseman MJ, Stockman ME, Milton RC.***
***Arch Ophthalmol 1997; 115: 1113-8.***

The purpose of this study was to examine the association between cigarette smoking and the incidence of nuclear and nonnuclear lens opacities in members of the Framingham Eye Study Cohort.

Eye examinations were conducted on surviving members of the Framingham Heart Study Cohort from 1973 to 1975 (Framingham Eye Study 1) and again from 1986 to 1989 (Framingham Eye Study II). Smoking data, collected biennially since 1948 in the Heart Study, were used to examine the relationship between cigarette smoking and the incidence of lens opacities. Two thousand six hundred seventy-five persons were examined in the Framingham Eye Study I. Our analysis included 660 persons, aged 52 to 80 years, who were free of lens opacities at the first eye examination.

During the approximately 12.5 years between eye examinations, lens opacities developed in a total of 381 persons, with nuclear opacities constituting the most frequent type. In logistic regression analyses that controlled for age, sex, education, and diabetes, a significant positive association with increasing duration of smoking and number of cigarettes smoked daily was found for nuclear lens opacities, alone or in combination (test for trend, $P<.002$), but not for nonnuclear opacities (test for trend, $P=.62$). Among the heavier smokers (persons who smoked $\geq 20$ cigarettes per day according to 6 or more biennial Framingham Heart Study examinations), 77% were still smoking at the time of the first eye examination. Persons who smoked 20 or more cigarettes per day at the time of the first eye examination were at substantially increased risk for the development of nuclear opacities than nonsmokers (odds ratio, 2.84;95% confidence interval, 1.46-5.51). There was no apparent excess risk for persons with nonnuclear lens opacities (odds ratio, 1.42;95% confidence interval, 0.65-3.07).

In conclusion, this study provides further evidence that cigarette smokers have an increased risk of developing nuclear lens opacities. The risk was greatest for heavier smokers, who tended to be current smokers and who smoked more cigarettes and for a longer duration.

**Human Photoreceptor Transplantation in Retinitis Pigmentosa**
***Kaplan HJ, Tezel TH, Berger AS, Wolf ML, Del Priore LV***
***Arch Ophthalmol 1997; 115: 1168-72.***

The purpose of this study was to establish the technical feasibility and safety of photoreceptor transplantation in retinitis pigmentosa.

A sheet of human photoreceptor cells was harvested from 2 human cadaveric eyes with a vibratome and transplanted into the subretinal spaces of 2 patients with advanced retinitis pigmentosa and visual acuity of no light perception by means of submacular surgery techniques. Preoperative and postoperative electrophysiologic testing, fundus photography, fluorescein angiography, and scanning laser ophthalmoscopy were performed.

Twelve months after photoreceptor transplantation, the visual acuity of each patient remained no light perception. The temporal edge of the retinotomy in 1 patient was folded but was not associated with a retinal detachment. The patients were not immunosuppressed, and there was no evidence of rejection of the allogeneic transplant. Cystoid macular edema, uveitis and macular pucker were not observed.

In conclusion, a sheet of adult human photoreceptor cells can be harvested from human cadaveric eye and safely transplanted to the subretinal spaces of patients with retinitis pigmentosa without systemic immunosuppression.

### Retinal Detachment after Branch Retinal Vein Occlusion

*Influence of the Type of Break on the Outcome of Vitreous Surgery*

***Ikuno Y, Tano Y, Lewis JM, Ikeda T, Sato Y. Ophthalmology 1997; 104: 27-32.***

Branch retinal vein occlusion (BRVO) is occasionally complicated by two types of retinal breaks (retinal holes without vitreous traction or retinal traction tears) that may lead to a rhegmatogenous retinal detachment (RRD). The authors describe surgical results of vitrectomy for RRD after BRVO and investigate whether there is any difference between clinical features or surgical results from eyes with the two types of retinal breaks.

The authors retrospectively studied 25 patients (25 eyes) who underwent vitrectomy for RRD after BRVO. Twelve of 25 eyes (48%) had a detachment secondary to one or more retinal holes (group 1), and 13 of the eyes (52%) had one or more retinal tears (group II).

Seventeen of the eyes (68%) achieved total retinal reattachment after the initial surgery; 22 (88%) did so by the time of final examination. Patients with retinal holes achieved more favorable final vision than those with retinal tears (P=0.0391). A higher rate of preoperative macular detachment (P=0.0112) and a higher rate of recurrent retinal detachment after initial vitrectomy (P=0.0302) were the factors associated with the reduced final visual acuity in patients with retinal tears. The increased rate of recurrent retinal detachment in patients with retinal tears was associated with a higher rate of existing preretinal neovascular membranes (P=0.0112) and a trend toward an increased incidence of intraoperative iatrogenic retinal breaks.

The authors concluded that among patients who undergo vitrectomy for RRD after BRVO, better surgical results are expected in eyes with retinal holes without vitreous traction than in those with retinal traction tears. This difference is thought to be due to the difference in vitreoretinal anatomy between eyes with the two types of retinal breaks.

### Perifoveal Capillary Network in Patients with Acute Central Retinal Vein Occlusion

***Remky A, Wolf S, Knabben H, Arend O, Reim M. Ophthalmology 1997; 104: 33-7.***

Reduction of visual acuity in patients with central retinal vein occlusion(CRVO) is often caused by macular edema and ischemia. The major causative factor of macular changes may be a disturbance in the macular microcirculation. The authors studied the perifoveal microcirculation in patients with central retinal vein occlusion to quantify the extent of circulatory deficiency in the macular circulation.

Twenty-four patients (8 men, 16 women) with recently diagnosed CRVO were included in this study. The following data were quantified: mean capillary blood velocity (CBV), foveal avascular zone (FAZ), and mean perifoveal intercapillary area (PIA).

In patients with CRVO, the mean flow velocity was significantly reduced compared with healthy subjects ($1.63\pm 0.220$ mm/sec vs $2.89\pm0.41$ mm/sec, $P < 0.01$). The FAZ and the mean PIA characterizing capillary density were significantly enlarged in CRVO ($5548\pm1151$ um$^2$ vs $3872\pm529$ um$^2$; $P < 0.01$).

The study demonstrated that CRVO not only led to a decrease in capillary blood velocities, but also to an enlargement of perifoveal intercapillary areas in early stages of the disease.

### The Association of Strabismus, Amblyopia, and Refractive Errors in Spasmus Nutans

***Young TL, Weis JR, Summers CG, Egbert JE. Ophthalmology 1997; 104: 112-7.***

Spasmus nutans is a condition that includes asymmetric nystagmus and occurs during the amblyogenic period. Because specific alterations in early visual experience are known to be associated with changes in visual development, relations between spasmus nutans and abnormal visual sequelae were examined.

The records of 18 patients with spasmus nutans were reviewed retrospectively. The incidence of strabismus, amblyopia, anisometropia, and astigmatism was compared with published age-matched control subjects.

There was a significantly higher incidence of strabismus (10 of 18) and amblyopia (8 of 18) of the eye with the greater amplitude of nystagmus. No correlation of refractive error with lateralization of nystagmus could be established. Twelve of 18 patients required spectacles for improvement in visual acuity and for treatment of amblyopia. Best-corrected visual acuity averaged 1.20 Snellen lines poorer than age-adjusted normative values; however, loss of visual

acuity was, in most cases, symmetric and not related to lateralization of nystagmus.

In conclusion, early detection and treatment of anticipated abnormal visual issues in patients with spasmus nutans will optimize visual outcomes.

### Delay of Corneal Wound Healing in Patients Treated with Colchicine

***Alster Y, Varssano D, Loewenstein A, Lazar M. Ophthalmology 1997;104:118-9.***

Colchicine has a known adverse effect on wound healing through its inhibitory effect on tubulin-dependent cell functions and through collagenase activation. In the cornea, it has been shown in animal and in vitro studies to inhibit epithelium mitosis, fibroblast mitosis and migration, as well as to reduce collagen deposition. The authors report on two patients with corneal ulcers refractory to conventional treatment while the patients were undergoing oral colchicine therapy.

The first patient was an 86-year-old woman who had been treated with oral colchicine because of rheumatoid arthritis. She was admitted to the authors' department with a deep corneal ulcer in the right eye for which she had been treated for 3 weeks with local antibiotics without any improvement. The second patient, a 60-year-old woman, was hospitalized because of a corneal ulcer in her left eye. She had been receiving oral colchicine therapy for mixed connective tissue disease. Treatment with local antibiotics was initiated but the condition of the eye worsened, ultimately resulting in corneal perforation.

Withdrawal of oral colchicine therapy was followed by rapid corneal wound healing in both patients.

The findings in these two patients suggest that colchicine may delay corneal wound healing. The authors suggest that in patients with corneal ulcers refractory to conventional treatment who are receiving colchicine, cessation of colchicine therapy should be considered.

### Limbus-versus Fornix-based Conjunctival Flaps in Combined Phacoemulsification and Mitomycin C Trabeculectomy Surgery

***Berestka JS, Brown SVL. Ophthalmology 1997;104:187-96.***

The purpose of this study was to compare the effectiveness of limbus-and fornix-based conjunctival flaps in patients undergoing combined phacoemulsification, intraocular lens implantation, and mitomycin C trabeculectomy.

The authors conducted a retrospective review of the records of 52 consecutive eyes of 45 patients who underwent combined surgery with limbus-and fornix-based conjunctival flaps. All surgery was done by one surgeon on predominantly white patients in a suburban glaucoma subspecialty practice. Seven patients had both limbus-and fornix-based surgery, permitting fellow eye comparisons in these patients. All patients had at least 6 months and a median of 17 months follow-up. None of the eyes that were operated on had undergone intraocular surgery previously.

No clinically significant difference in postoperative pressure reduction, bleb survival, or visual acuity was seen between the fornix-and limbus-based groups. Results in the fellow eye comparison subgroups were similar. The mean intraocular pressure decreased from 20.4 mmHg before surgery to a mean of 12.4 mmHg at the last follow-up visit. Forty-seven (90.3%) of 52 eyes had a final best-corrected visual acuity of 20/40 or better. Forty eyes (76.9%) no longer needed antiglaucoma medications at the end of follow-up. Five eyes had intraoperative posterior capsule rupture; all of these occurred in the limbus-based group. Shallow serous choroidal effusions were more common in the fornix-based group but none were clinically significant. No difference in postoperative astigmatism between the limbus-or fornix-based group was seen. Intraoperative pupilloplasty, synechialysis, or postoperative neodymium: YAG capsulotomy had no appreciable effect on final intraocular pressure or bleb survival. Endophthalmitis, aqueous misdirection, or hypotony maculopathy did not develop in any patient.

In conclusion, the effectiveness of limbus-and fornix-based conjunctival flaps appears to be similar. The limbus-based technique may result in a higher incidence of posterior capsular rupture, but the safety of limbus-and fornix-based flaps is otherwise similar. Combined phacoemulsification and mitomycin C trabeculectomy appears to be safe and effective for treating selected patients with coexisting glaucoma and cataract.

### Effect of Trabeculectomy on Visual Field Performance in Central 30° Field in Progressive Normal-tension Glaucoma

***Koseki N, Araie M, Shirato S, Yamamoto S. Ophthalmology 1997; 104: 197-201.***

The authors studied the effects of trabeculectomy on the time course of central 30° visual field

performances in progressive normal-tension glaucoma (NTG).

Patients with NTG who had clear ocular media and were adequate performers on the 30-2 program of Humphrey Perimeter were prospectively followed with periodic field testing. Trabeculectomy using an antimetabolite was indicated when the slope of a line fitted to the time course of the mean deviation (MD), MD slope, was significantly negative. The time courses of MD and mean of total deviations (Mean TD) in four subfields, superior and inferior arcuate and superior and inferior cecocentral fields, were analysed using the mixed linear model.

In progressive NTG, 21 eyes of 21 cases with postoperative follow-up of 2 years or more, intraocular pressure averaged 16 mmHg, MD averaged -13.5 dB, and MD slope averaged -1.48 dB/year preoperatively; 2 years after surgery, they averaged 9.2mmHg, -13.6 dB, and +0.13 dB/year, respectively. Trabeculectomy had a significant beneficial effect on the time course of MD and mean TD in the superior and inferior arcuate and superior cecocentral fields, which showed significant preoperative deterioration. The mean TD in the inferior cecocentral field showed no significant time change during the period studied.

In conclusion, for patients with NTG in whom the MD slope is significantly negative, trabeculectomy may have beneficial and diffuse effects on further deterioration of the visual field.

### Correlation of Goblet Cell Density and Mucosal Epithelial Membrane Mucin Expression with Rose Bengal Staining in Patients with Ocular Irritation

***Pflugfelder SC, Tseng SCG, Yoshino K, Monroy D, Felix C, Reis BL.***
***Ophthalmology 1997;104:223-35.***

This study was designed to compare goblet cell densities and mucosal epithelial membrane mucin (MEM) expression in impression cytology specimens obtained from control subjects and patients with one of the following clinically defined diseases: aqueous tear deficiency (ATD) associated with Sjogren syndrome, ATD not associated with Sjogren syndrome, inflammatory Meibomian gland disease associated with rosacea, and Meibomian gland atrophy. These data were correlated with ocular surface rose Bengal staining scores, Schirmer scores, and HLA-DR antigen staining of conjunctival epitheiial cells.

Goblet cell density and MEM expression were studied by impression imprints with immunohistochemical staining using an anti-mucosal epithelial membrane mucin antibody in the temporal and inferior bulbar and inferior tarsal conjunctiva of study subjects.

Goblet cell density adjacent to the temporal limbus was significantly reduced at 3 mm posterior to the temporal limbus in both aqueous tear deficiency groups compared with the other groups and in patients with Sjogren syndrome compared with all other groups. In the inferior tarsus, goblet cell density was significantly reduced in patients with non-Sjogren syndrome ATD as compared with all other groups, except those with inflammatory Meibomian gland disease. Mucosal epithelial membrane mucin expression in the bulbar and tarsal conjunctiva was absent in a greater percentage of patients with Sjogren syndrome compared with all other groups. Total ocular surface rose Bengal staining scores were significantly higher in patients with Sjogren syndrome as compared with all other groups and in patients with non-Sjogren syndrome ATD as compared with control groups. Rose Bengal staining scores and Schirmer 1 test results (without anesthesia) were inversely correlated with bulbar, but not tarsal, conjunctival goblet cell densities, and with the absence of bulbar conjunctival MEM expression.

These results suggest that reduced goblet cell density and mucosal epithelial cell mucin expression could explain increased rose Bengal staining in patients with aqueous tear deficiency. In addition, MEM may be regarded as a marker for normal differentiation of ocular surface epithelia, with its absence signifying the development of squamous metaplasia.

### Lens Clarity after Lens-sparing Vitrectomy in a Pediatric Population

***Ferrone PJ, Harrison C, Trese MT.***
***Ophthalmology 1997; 104: 273-8.***

The purpose of the study was to assess lens clarity after pediatric lens-sparing vitrectomy.

The study offers a retrospective analysis of 85 eyes of 77 pediatric patients who underwent lens-sparing vitrectomy for tractional retinal detachment or opaque media, and who were observed for 10 to 55 months.

A total of 57 eyes maintained clear lenses at last follow-up examination. Cataract was found in 13 (15%) of the 85 eyes. Fifteen eyes (18%) had undergone lens removal as part of reoperation for progressive ocular disease.

Sixty-seven percent of pediatric lenses remained clear after lens-sparing vitrectomy.

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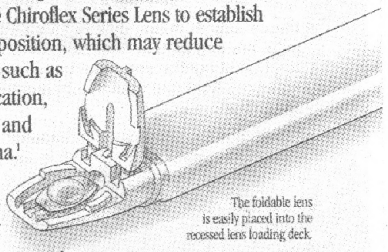

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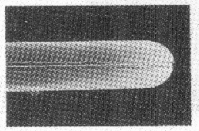

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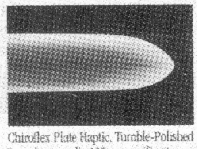

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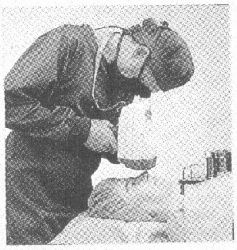

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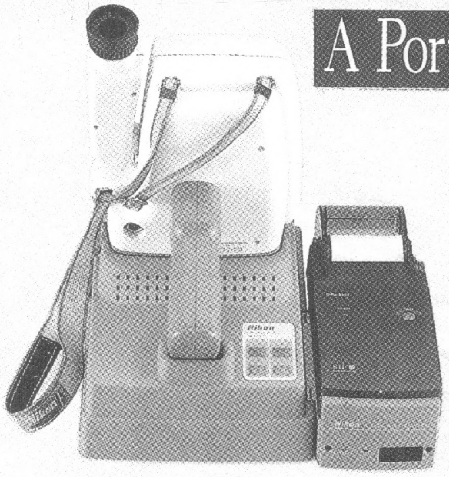


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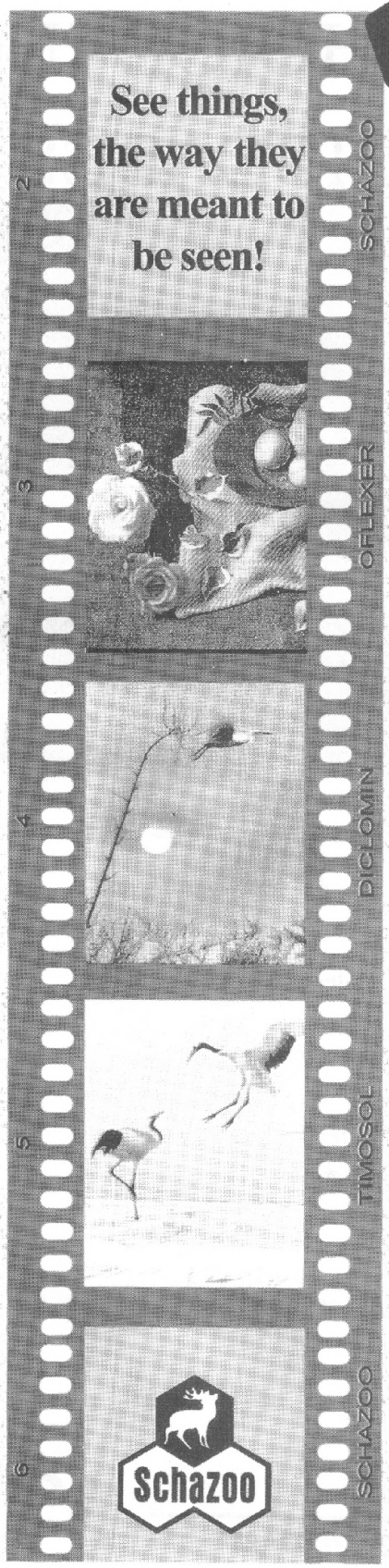


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1- (PDR Ophthalmology 1995)
2- (SO: Br-J-Ophthalmol 1993 Nov; 75(11): 675-9).
3- (SO: Yen-Ke-Hsueh-Pao 1994 Dec; 10(4): 251-3).
4- (SO: Br-J-Ophthalmol 1995 Jun; 79(6):606-9).
5- (SO: J-Cataract-Refract-surg 1995 May; 21(3): 309-12).
6- (SO: J-Fr-Ophthalmol 1992; 15(1): 5-8 ).
7- (SO: Refract-Corneal-Surg 1993 Nov-Dec; 9(6):425-36).
8- (SO: Inflight 1993 Apr;18(1):65-9 FI).
9- (Comparison between timolol & levobunolol,'showing percentage of withdrawals M.Ober et. al., Br. J. Ophthal., 1985;69,593 ).
10 & 11- (AFHS, Drug information '92, page #1705).


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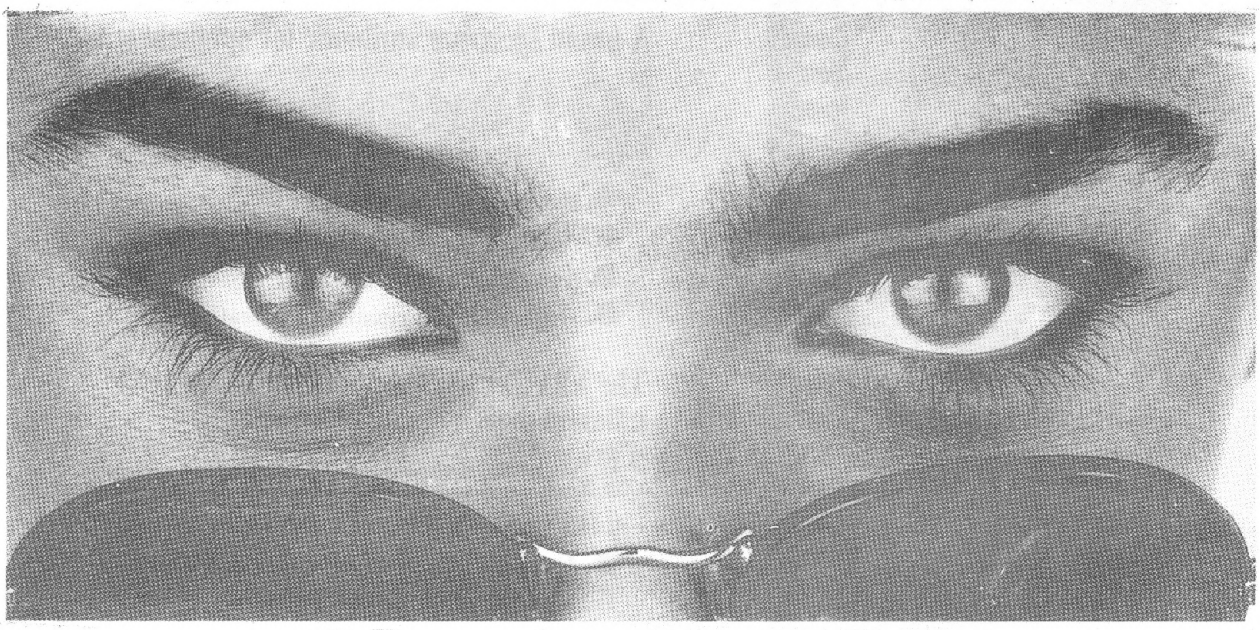

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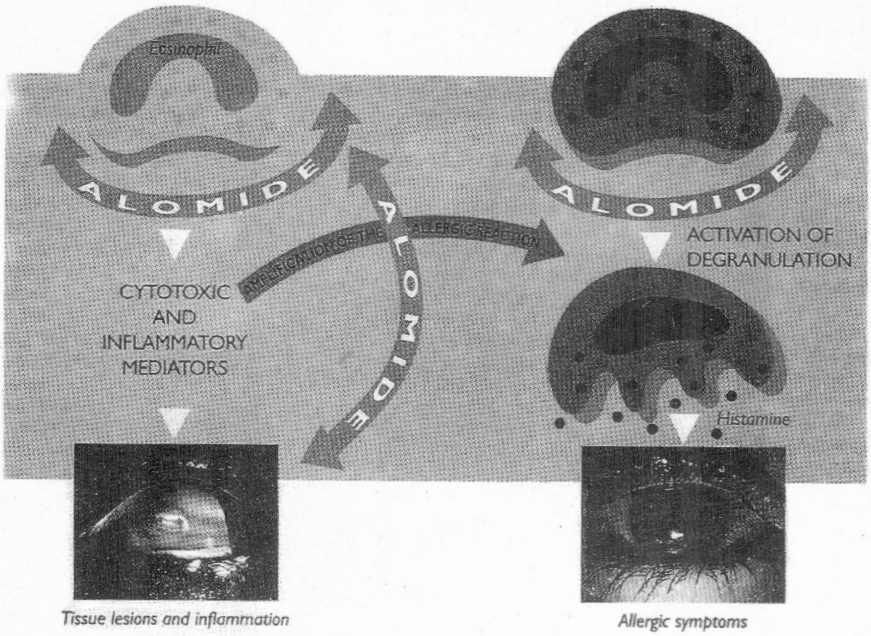


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