

**A PROSPECTIVE STUDY OF VISUAL  
OUTCOME IN LENS INDUCED GLAUCOMAS  
FOLLOWING SURGERY**

**DISSERTATION SUBMITTED FOR**

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## **CERTIFICATE**

This is to certify that this dissertation entitled “**A PROSPECTIVE STUDY OF VISUAL OUTCOME IN LENS INDUCED GLAUCOMAS FOLLOWING SURGERY**” has been done by **DR. M. SMITHA** under my guidance in Department of OPTHALMOLOGY, Madurai Medical College, Madurai.

I certify regarding the authenticity of the work done to prepare this dissertation.

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## **DECLARATION**

I, **Dr. M. SMITHA** solemnly declare that the dissertation titled **“A PROSPECTIVE STUDY OF VISUAL OUTCOME IN LENS INDUCED GLAUCOMAS FOLLOWING SURGERY”** has been prepared by me.

This is submitted to The Tamil Nadu Dr. M.G.R. Medical University, Chennai, in partial fulfillment of the requirement for the award of M.S.,(Ophthalmology) Branch - III degree Examination to be held in MARCH 2008.

**Place : Madurai**

**Date :**

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## **AIM OF THE STUDY**

**To determine the frequency and types of lens – induced glaucoma and outcome of current management.**

## INTRODUCTION

Cataract and glaucoma are the leading causes of blindness through out the world.

Of the total 45 million blind persons (Visual acuity  $< 3/60$ ) in the world, 7 million are in India. Glaucoma accounts for 5.8% of all types of blindness in India with a prevalence of 4% in population aged 30 years and above.

Glaucoma is not a single disease process. It is a group of disorders characterized by widely different clinical and histopathological manifestation.

These disorders share characteristic changes in visual field, optic nerve head and usually have increase in Intra ocular pressure. Intraocular pressure is only a risk factor.

There are many etiologies of glaucoma lens induced glaucoma is one of them.



## CLASSIFICATION OF GLAUCOMA

Glaucoma may be classified into

### **Primary:**

Here the pathology is confined to AC angle or conventional aqueous outflow pathway with no apparent contribution from other ocular or systemic disorder.

This may be divided into 3 main categories.

1. Open angle
2. Closed angle
3. Congenital

### **Secondary :**

Glaucoma in which there is a predisposing ocular / systemic event. Though this form a small proportion of all types of glaucoma they frequently produce the most difficult problems in diagnosis and management.

The secondary glaucoma may be classified according to the mechanism by which intra ocular pressure is increased.

## 1) **Outflow obstruction :**

- a. Pre trabecular block from iris – trabecular contact or adhesion.
  - i. With pupil block
  - ii. Without pupil block
- b) Trabecular block – due to damage to mesh work  
Eg secondary open angle glaucoma
- c) Post trabecular block – from episcleral venous pressure

## 2) **Hypersecretion glaucoma** - Rare cause eg. Epidemic dropsy

Secondary glaucoma may occur due to many reasons, one of which is a sub group called Lens induced glaucoma, where lens is the prime factor responsible for glaucoma.

### **Few varieties of lens induced glaucoma are as follows.**

- a) Phacomorphic glaucoma : Swollen lens causes increased pupillary block and secondary angle closure.
- b) Dislocated lens : Dislocated lens causes, increased pupillary block and angle closure.
- c) Phacolytic glaucoma : Lens protein leaks from an intact capsule and obstructs the trabecular meshwork.

- d) Lens particle glaucoma : Lens matter liberated by means of surgery or trauma blocks outflow.
- e) Phacoanaphylaxis : Granulomatous inflammation following sensitization to lens proteins causes secondary glaucoma.

**PATHOGENESIS, CLINICAL FEATURES, DIAGNOSIS,  
MANAGEMENT OF EACH TYPE OF LENS  
INDUCED GLAUCOMAS.**

**PHACOLYTIC GLAUCOMA (Lens Protein Glaucoma) :**

Hypermature or mature rarely immature cataracts may leak lens proteins into aqueous humor and obstruct the aqueous outflow channels. This form of lens induced open angle glaucoma is called phacolytic glaucoma although some studies suggest lens protein glaucoma may be an appropriate term.

In 1900 Gifford described a form of open angle glaucoma associated with a hypermature cataract. Irvine and Irvine suggested that Blockage of trabecular meshwork by macrophages was the principal mechanism of glaucoma.

Flocks et al proposed the term phacolytic glaucoma for the open angle glaucoma associated with a leaking hypermature cataract. They believed that glaucoma was caused by obstruction of the intertrabecular spaces by macrophages. Epstein et al provided evidence that high molecular weight lens protein may be primarily responsible for the obstruction to aqueous outflow in this disorder and the term lens protein glaucoma has been suggested.

### **PATHOGENESIS :**

The amount of high molecular weight soluble lens protein increases with age and cataract formation and is nearly absent in the lenses of infant and juvenile patients. High molecular weight protein is commonly found in the nucleus, rather than in the cortex of the lens. In phacolytic lenses, however high concentration of this protein are found in the liquid cortex, possibly indicating either a nuclear disintegration process or further cortical protein aggregation. By virtue of the size, high molecular weight soluble lens protein may be expected to obstruct the trabecular outflow pathways if liberated in sufficient quantities.

The lens protein ordinarily are sequestered within capsule and isolated from the remainder of the eye. During phacolysis microscopic defects occur in the anterior and posterior lens capsule through which soluble lens proteins enter the aqueous humor. These microscopic leaks probably reflect an end stage in the process of cataract formation.

Morphologically, eosinophilic protein like material and macrophages have been observed in the trabecular meshwork of eyes with phacolytic glaucoma. The presence of macrophages is a natural response to the presence of lens material in the AC and studies have demonstrated that lens protein especially, gamma crystalline lens proteins can induce the migration of peripheral blood monocytes. The macrophages have been shown by electron microscopic studies to have phagocytosed degenerated lens material.

Against the macrophagic theory is the observation that lens laden macrophages in the anterior chamber do not invariably lead to elevated IOP. For example, a macrophagic cellular reaction has been found in the anterior chamber aspirate after needling and

aspiration of a cataract, but did not appear to obstruct aqueous outflow.

HMW protein is rare in childhood lenses which may explain why phacolytic glaucoma rarely occurs in children.

### **CLINICAL FEATURES :**

The term phacolytic glaucoma should be reserved for the sudden onset of open angle glaucoma caused by a leaking mature or hypermature cataract.

The typical patient presents with an acute onset of monocular pain and redness. There is usually a history of gradual reduction in visual acuity over the preceding months or years. Vision at the time of presentation may be reduced to light perception. The examination reveals a high IOP, and conjunctival hyperemia.

On S/L examination diffuse corneal edema is present. An intense flare in AC which has been attributed to soluble lens proteins is commonly observed. KPs will be absent usually. The visible cells are macrophages, which are larger and more translucent than typical leucocytes. In some cases pseudo hypopyon is present.

Aggregates of white material can be seen circulating in Aqueous humor represents small particles of lens material, cellular aggregate or insoluble lens protein. Calcium oxalate crystals or cholesterol crystal may also be present in aqueous humor. The latter appear as iridescent or hyper refringent particle in both lens and aqueous are a helpful diagnostic sign. The cataract is usually mature or hypermature. Soft white patches representing macrophages phagocytosing lens proteins at leaks in the capsule, typically are present on the lens capsule.

On gonioscopy the anterior chamber angle is open, usually without obvious abnormalities. Retinal perivasculitis has been reported with phacolytic glaucoma. The perivasculitis rapidly resolved when lens protein leakage ceased.

If the cataract is dislocated into the vitreous the signs of phagocytosis are often subtle. The eye may be only slightly injected with moderate IOP elevation and AC reaction. Observable white patches on the lens capsule provide an important clue to diagnosis.

### **Special diagnostic technique :**

Diagnostic paracentesis reveal typical engorged macrophages as microscopic examination. Phase contract microscopy and the Millipore filter technique may identify the macrophages.

### **Differential Diagnosis :**

The acute intraocular pressure elevation associated with phacolytic glaucoma must be differentiated from that of pupillary block glaucoma, phacomorphic glaucoma, neovascular glaucoma, glaucoma associated with uveitis.

On S/L examination AC cellular reaction in phacolytic glaucoma consists of larger, translucent macrophages and the iridescent particles. This cellular reaction contrasts with the small leucocytes present in most inflammatory glaucoma.

When phacolytic glaucoma occurs with a lens that is dislocated into the vitreous different diagnosis includes chronic open angle glaucoma, angle recession glaucoma and pupillary block glaucoma.



## MANAGEMENT

### **Medical Management :**

Appropriate management of phacolytic glaucoma includes initial control of IOP and subsequent cataract extraction. The IOP may be lowered by hyperosmotic agents, carbonic anhydrase inhibitors, topical Beta adrenergic antagonists. Topical corticosteroid is useful to decrease the inflammation response preoperatively. A trial of diagnostic steroid therapy may differentiate phacolytic glaucoma from uveitic glaucoma.

### **Surgical therapy :**

Because of the magnitude of IOP elevation and its refractoriness to medical therapy, it often becomes, necessary to remove the cataract soon after the condition has been diagnosed. Retrobulbar or peribulbar anesthesia with epinephrine to decrease orbital vascular congestion is preferable. If the IOP is high AC should be entered gradually to prevent rapid decompression of the globe. ECCE with PCIOL can often be performed with good results. The anterior chamber should be thoroughly irrigated and all lens material removed to avoid post operative IOP rise. After uncomplicated

cataract surgery the glaucoma usually clear and there is often a return of good vision, despite a significant preoperative reduction.

Trabeculectomy was added to standard cataract surgery if symptoms endured for more than 7 days or if preoperative control of IOP with maximum medical therapy was inadequate. It prevents post operative rise in IOP and decrease the need for systemic hypotensive medications.

### **PHACOMORPHIC GLAUCOMA :**

Aqueous humor dynamics - Aqueous is secreted by ciliary body into the posterior chamber bounded posteriorly by lens anteriorly by iris.

Aqueous then passes through the pupil into AC bounded by iris posteriorly and cornea anteriorly. Thus pupil forms a window between anterior and posterior chamber. It then exits the interior of the eye through the angle between iris and cornea across the trabecular mesh work and through the draining channels.

Thus intra ocular pressure can rise if aqueous pathway is blocked any where in the course of its drainage or if more aqueous is secreted.

It can be seen that lens guarding the posterior aspect of aqueous pathway can cause havoc if it swells. This is what happens in phacomorphic glaucoma when the lens swells.

## **EVOLUTION OF CATARACT**

An opacifying lens may go through stages of lamellar separation, cleft formation, incomplete (immature) and mature (complete) opacification. It may even progress to total cortex liquefaction with cortical escape and capsule wrinkling (hyper mature) stage.

Pathologically clefts are watery or eosinophilic material probably representing altered protein fragments and broken up cortical cells that round up at these edges. These form the Morgagnian globules. The cytoplasm is liquefied. More such corpuscles are formed and replace normal cortex.

This together with the denatured protein increases osmolarity of the substance within the lens capsule and absorbs fluid. This increase in antero posterior diameter causes intumescence.

The sequence can further progress with globules and abnormal protein replacing the entire cortex resulting in mature (liquefied or

morgagnian) cataract. The nucleus then sinks inferiorly due to gravity.

In cases where the fluid particles are of sufficiently small size, they may escape through the intact capsule and result in a smaller than normal lens with wrinkled capsule forming hypermature cataract.

Disproportionate increase in lens size very rarely can happen in densely sclerosed lens too.

Other causes of lens swelling can be trauma and inflammation leading to rapid lens swelling resulting in pupillary block or forward displacement of lens iris diaphragm.

The enlarging lens then pushes the iris forwards and narrows the irido-corneal angle. Increased apposition between iris and lens obstructs the aqueous flow from posterior to anterior chamber through the pupil and leads to accumulation of aqueous behind iris, pushing it anteriorly and causing iris bombe configuration leading to closure of drainage angle.

In extreme cases lens pushes iris forward obliterating the anterior chamber angle. This altered anatomy of lens touching the iris,

pushing against the cornea and angle structures, increased IOP all can initiate intra ocular inflammation.

This over time can lead to all complications of inflammation including adhesion between the angle structures and permanent angle closure.

**Thus the factors leading to raised IOP are**

- a) Pupillary block
- b) Appositional angle closure
- c) Associated inflammation
- d) synechial angle closure

### **CLINICAL PRESENTATION :**

Typical history would be gradual impairment of vision with sudden onset of pain, redness and there may be vomiting also, with worsening of vision like acute angle closure attack.

Examination might show some lid edema, superficial and circumcorneal ciliary congestion, corneal edema may be variable, proportional to increase in IOP.

The AC characteristically is uniformly shallow, iris may show alteration in colour and pattern, pupil generally is mid dilated with

sluggish or no reaction or even RAPD depending on the optic nerve damage inflicted.

Lens will be usually swollen and soft. IOP is elevated. Gonioscopy if possible (with medical treatment and corneal deturgescence with topical glycerin) reveals initially appositionally closed and later synechially closed angles.

It is extremely important to evaluate other eye for correct diagnosis of phacomorphic glaucoma. A gonioscopic examination of the other eye has to be done in all cases. If the angle is found to be open, then diagnosis in the affected eye is established to be strictly a secondary angle closure glaucoma.

Conversely, if the fellow eye has occludable angles, then one is dealing with an accelerated form of primary angle closure glaucoma in an eye already predisposed to papillary block thus questioning the diagnosis and being more in favor of primary angle closure.

### **MANAGEMENT:**

Phacomorphic glaucoma is an ocular emergency and should be managed promptly. The definite treatment in eyes with potential for

vision is lens extraction. The immediate medical treatment is identical to primary acute angle closure glaucoma.

Regarding the use of miotics different people have different opinion. According to few pilocarpine plays a vital role as it prevents the formation of peripheral anterior synechiae by constricting the pupil. Some people says it aggravates pupillary block by increasing the lens thickness and causes anterior lens movement and thus further shallow the anterior chamber.

The goal of treatment is to reduce IOP to safe levels before proceeding for surgery.

Topical Beta adrenergic blocks, topical alpha agonists topical and systemic carbonic anhydrase inhibitors, and hyperosmotic agents can be used alone or in combination as necessary with topical steroids.

With these IOP and inflammation will come down and patient improves symptomatically and corneal edema decreases. Analgesics, antiemetics may also be used as required.

If the surgery is delayed a laser peripheral iridotomy may be performed. As the initial mechanism of angle closure in phacomorphic glaucoma involves pupillary block, management of such cases may be

identical to those with primary angle closure attack namely by iridotomy after the intraocular pressure is lowered medically and pupil is constricted as much as possible with a miotic agent.

It is important to re evaluate the anterior chamber angle after iridotomy. Iridotomy may not be curative in all cases especially those in which direct pressure from lens is playing a greater role than the pupillary block.

If the patient has medically unresponsive attack of angle closure, Argon laser iridoplasty as the initial laser procedure may be also successful in opening the angle.

This approach allows sometime for the intraocular inflammation to resolve before performing laser iridotomy, there by eliminating the need for intraocular surgery on an inflammed eye with a markedly raised intraocular pressure.

Regarding the surgical management of phacomorphic glaucoma different surgeons have different opinion.

Cataract extraction usually normalizes IOP unless the angle is damaged by peripheral anterior synechiae. According to some cataract



extraction is adequate while others believe that trabeculectomy should be combined with this.

According to Lyme B kaplinsky and B. Thomas Hutchison in cases in which synechial angle closure is evident a chamber deepening procedure with cataract extraction and IOL placement may be warranted while combined cataract extraction and trabeculectomy should be performed if angle remains closed after therapeutic chamber deepening.

**Technique :**

A paracentesis is made and aqueous is drained. Anterior chamber is injected with high molecular weight viscoelastic substance. Intra operative gonioscopy is performed to visualize extent of synechial closure and to decide if filtering surgery is needed. Early synechia can sometimes be lysed.

It has been observed that simple cataract surgery with intraocular lens implantation is sufficient if most of the angle can be opened up with iridotomy or therapeutic chamber deepening (as evidenced by gonioscopy)

In practice, management comes to dwell on surgeon's preference some preferring plain cataract extraction and others combining it with filtering surgery (especially if presentation is late)

The prognosis for good post operative visual recovery and intraocular pressure control is guarded and depends on duration of presentation after the onset of acute symptoms.

### **LENS PARTICLE GLAUCOMA :**

This type of glaucoma is caused by liberation of lens particles and debris after the disruption of lens capsule and the term lens particle glaucoma has been proposed.

### **Clinical Features :**

Lens particle glaucoma is typically associated with disruption of lens capsule by cataract extraction or a penetrating injury. The onset of IOP elevation usually occurs soon after the primary event and is generally proportional to the amount of 'fluffed up' lens cortical material in the anterior chamber. Fragments of white cortical lens material may be seen circulating in the aqueous humor and lens debris may deposit on corneal endothelium. If the IOP is highly elevated, corneal edema may be present. Significant inflammation may

accompany this condition with heavy flare and cellular reaction in anterior chamber. The circulating white cells may include small leucocytes and larger more translucent macrophages. If a larger amount of free lens materials is present a hypopyon is observed. On gonio angle is open, cortical lens material is often present in angle. PAS may result from inflammation.

Some times a similar form of glaucoma occurs many years after ECCE surgery when lens material is freed into anterior chamber. Circulating chunks of whitish lens material then are seen in the anterior chamber. The cellular reaction is more macrophagic than in the immediate post operative condition.

### **PATHOGENESIS :**

It has been demonstrated with perfusion studies that small amount of free particulate lens material significantly reduce outflow. This is presumed to be the principal mechanism of trabecular mesh work obstruction in case of lens particle glaucoma. However the associated inflammation, whether in response to surgery, trauma or retained lens material may contribute to glaucoma.

## **DIAGNOSIS :**

In the typical post operative or post penetrating trauma patient lens particle glaucoma usually is diagnosed when clinical findings indicate significant quantities of free cortical lens material in the aqueous humor and increase in IOP. If only small amounts of lens material can be seen or if the clinical presentation is atypical AC tap or microscopic examination of fluid may aid in the diagnosis by identifying macrophages and fragments of suspected lens material.

## **MANAGEMENT :**

### **MEDICAL THERAPY :**

Medical therapy of lens particle glaucoma consists of a combination of carbonic anhydrase inhibitors, topical beta adrenergic antagonists, apraclonidine and temporary hyperomotics. Miotics should be avoided because these patients tend to form synechiae. Cycloplegics should be used to dilate the pupil. Topical corticosteroids are also used to treat the commonly present inflammation. It should be used in moderate amounts because steroid therapy may delay absorption of lens material.

## **SURGICAL THERAPY :**

If glaucoma from retained lens cortex does not respond quickly and adequately to the previously mentioned medical therapy lens material should be surgically removed without delay. In early stages of the disorder, lens material is loose and is early aspirated from the anterior chamber resulting in dramatic cure of glaucoma. If surgery is delayed lens material may be trapped with in the capsule or inflammatory membrane. In this situation microvitrectomy instruments are valuable in removing trapped lens material through a closed incision. Surgical removal of lens material is usually sufficient to control IOP elevation and additional glaucoma surgery is rarely required.

## **PHACOANAPHYLAXIS GLAUCOMA :**

In 1922, Verhoeff and Lemoine reported a few individuals were sensitive to lens protein and that rupture of lens capsule in these cases led to intraocular inflammation which they called 'endophthalmitis phacoanaphylactica'. There is evidence that a true phacoanaphylaxis does occur in response to lens protein antigen with subsequent inflammation and occasional open angle glaucoma.

## **CLINICAL FEATURES :**

Phacoanaphylaxis is a rare granulomatous inflammation that develops uncommonly after lens injury. It infrequently causes glaucoma and infact is usually associated with hypotony.

Phacoanaphylaxis occurs in the following clinical situations that allow sensitization to previously isolated lens proteins.

1. After extracapsular extraction or phacoemulsification with out vitreous loss.
2. After extracapsular extraction or phaco in one eye, with subsequent ECCE or phacoemulsification or a leaking mature or hypermature cataract in the other involved eye.
3. After spontaneous, traumatic or surgical rupture of lens capsule.

The clinical picture is variable and the diagnosis is not made until an enucleated eye is examined pathologically. The inflammatory reaction may occur with in hours or days or may be delayed for months after lens injury or surgery. The uveitis may be mild or virulent. A patient initially may experience only decreased vision or an acutely inflamed eye. On examination the anterior uveitis may be mild or a large hypopyon may be present. Lens

fragments may be present in AC. KP frequently present on cornea. Peripheral anterior and posterior synechiae commonly form as a part of inflammation. The uveitis can involve vitreous and inflammatory membrane can form. Typically the uveitis does not respond to topical, subconjunctival or systemic steroids. Removing an intraocular lens has no effect on uveitis. The process is nearly always unocular, although there have been reports of a sympathizing reaction in the fellow eye.

### **PATHOGENESIS :**

Phacoanaphylaxis was long believed to be due to an immune rejection of a sequestered foreign material that is released as a result of lens injury. However immunologic studies have shown that lens protein is normally recognized by the immune system and lens protein are found in the aqueous in eye with normal lenses and are found in some normal individuals and are increased in cataracts.

Consequently it has been postulated that phacoanaphylaxis represents an immune complex disease that develops when the normal tolerance to lens protein is lost rather than a cell mediated rejection of a

foreign tissue. Histopathologically phacoanaphylaxis is characterized by a typical granulomatous, inflammatory reaction. The damaged lens is surrounded by an extreme polymorpho nuclear leucocyte infiltrate. The infiltrate is surrounded by a zone of granulomatous inflammation containing multi nucleated giant cells and is in turn bordered by a non-specific mononuclear cell infiltrate. Eosnophils, plasmacells and histiocytes containing phagocyte lens material are frequently present.

Glaucoma in phacoanaphylaxis is due to multiple pathologic mechanism. Residual lens particles, proteins or both can obstruct the trabecular meshwork causing lens particle glaucoma. The inflammatory reaction may involve the trabecular meshwork causing or aggravating glaucoma. Topical corticosteroid used to treat the inflammation may cause steroid induced glaucoma. Peripheral anterior synechiae may form and cause angle closure glaucoma. Posterior synechiae may result in pupillary block glaucoma.

#### **DIAGNOSIS :**

The preceding clinical signs are a guide to the diagnosis but when in doubt or faced with relentless uveitis, one should surgically remove and microscopically examine the residual lens material. Diagnostic



paracentesis reveal foamy macrophages. Diagnostic vitrectomy also can be done.

### **DIFFERENTIAL DIAGNOSIS :**

Toxic reaction due to foreign material, infective endophthalmitis caused by bacteria of low virulence or fungus, phacolytic glaucoma, sympathetic ophthalmia includes the differential diagnosis .

### **MANAGEMENT :**

Surgical removal of residual lens material is required to cure the condition and a pars plana vitrectomy is the best option. All residual lens material must be removed. The removed lens material should be submitted for pathologic examination to verify the diagnosis.

Management of glaucoma depends on a proper diagnosis and definitive treatment of the phacoanaphylaxis. Glaucoma that is steroid induced or caused by inflammation may be controlled by topical beta adrenergic antagonists or carbonic anhydrase inhibitor, but requires control of uveitis for permanent control of glaucoma. Synechial angle closure glaucoma may be treated medically with antiglaucomatous medications or surgically by laser goniotomy, surgical goniosynechialysis or filtration surgery as needed. Pupillary block glaucoma

should be managed by laser or incisional surgical iridectomy followed by gonioscopy so that significant residual synechial closure can be appropriately managed.

## **ECTOPIA LENTIS**

The term ectopia lentis is applied to cases of lens dislocation or subluxation.

Conditions associated with ectopia lentis

Trauma is the most common cause

Simple ectopia lentis

Ectopia lentis at pupillae

Marfan's syndrome

Homocystinuria

Weill-Marchesani syndrome

High myopia

Uveitis

Buphthalmos

Ehlers –Danlos syndrome

Hyperlyseemia

Sulfite oxidase deficiency

Aniridia

## **Causes of glaucoma in the presence of ectopia lentis**

### **I - Lens related**

- a) Pupillary block by lens
- b) Pupillary block by lens and vitreous
- c) Lens in anterior chamber
- d) Phacolytic glaucoma
- e) Peripheral anterior synechiae caused by chronic angle closure

### **II Lens Unrelated:**

- a) Angle recession
- b) Chamber angle anomaly
- c) Coincident chronic open angle glaucoma
- d) Other terms of glaucoma related to an underlying disease process (eg. Ghost cell glaucoma, neovascular glaucoma)

### **MANAGEMENT:**

If the lens is displaced anteriorly in the anterior chamber or partially through the pupil it is possible to relieve the condition by dilating the pupil and allowing the lens to deposit back into posterior chamber. A miotic may be used to keep the lens behind the iris, but

miotic therapy should be avoided when pupillary block is caused by loose zonules as in microspherophakia.

The definitive treatment is laser iridectomy. The iridotomy should be placed peripherally to avoid subsequent obstruction by lens.

The extraction of subluxated lens is associated with increased surgical risk and should usually be avoided unless the lens is in the anterior chamber or lens extraction is needed to relieve the glaucoma or improve vision.

## REVIEW OF LITERATURE

1. A prospective study of 413 cases of lens – induced glaucoma in Nepal

(Pradhan Damodar, Henning Albrecht, Kumar Jitendra, Foster Alleen. Sangarmatha Choundhaey Eye Hospital, Lahan, Nepal, London school of Hygiene and Tropical Medicine London, United Kingdom. IJO 2001 volume 49 issue 2 page 103-107

### **Purpose :**

To determine the frequency and type of lens induced glaucoma, reasons for late presentation and outcome of current management

### **Methods :**

Prospective case series of 413 patients / eyes with lens induced. Glaucoma over a 12 month period in 1998 ; 311 of these patients underwent cataract surgery. Visual acuity and intraocular pressure were pre and post operatively assessed.

413 (1.5%) OF 27,073 senile cataracts seen in the outpatient department of Sagarematha Chaundhaey Eye Hospital, Lahan, Nepal presented with Lens induced Glaucoma. There were 298 (72%) phacomorphic cases and 115 (28%) phacolytic glaucoma. Pain for more than 10 days was reported by 293 (71%) patients. The majority 258 (62.4%) traveled a distance of more than 100 kms to the hospital. The major reasons for late presentation were 'no escort' in 143 (34.6%) and lack of money in 128 (31.0%) cases. At presentation IOP was more than 30 mmHg in 327 (79%) eyes. Following cataract surgery, 251 (80.7%) had IOP 21mm Hg or less at discharge. The visual acuity was hand movement or less before surgery in all eyes ; at discharge 120 of 311 operated eyes (38.6%) achieved 6/60 or better, 97 (37.2%) less than 6/60, and 94 (30.2%) less than 3/60. The main causes for poor vision in 94 cases were optic atrophy in 32 (34%) uveitis in 25 (26.6%) eyes and corneal edema in 24 (25.5%) eyes.

The results highlight the importance of early diagnosis and treatment of visually disabling cataract. There is a need to educate both the patient and the cataract surgeon of the danger of lens induced glaucoma and of poor outcome if treatment is delayed.

2. Lens induced Glaucomas – visual results and risk factors for final visual acuity. (Prajana N Venkatesh, Ramakrishnan R, Krishnadas R, Manoharan N, Aravind Eye Hospital and Post Graduate Institute of Ophthalmology, Madurai IJO 1996, volume-44 issue 3 page 149-155.

Lens induced glaucomas are a common occurrence in India. An attempt was made to understand the clinical modes of presentation and post operative visual results in 93 patients with lens induced glaucoma, 49 phacomorphic and 44 phacolytic, attending Aravind institute during 1994. All these patients were subjected to a planned extra capsular extraction. Forty four percent had a posterior chamber Intra ocular lens implantation following surgery.

Fifty seven percent eyes with phacomorphic glaucoma and 61% with phacolytic glaucoma recovered visual acuity of 6/12 or better. There was no significant difference in the final visual acuity between those patients who had an intra ocular lens implanted and those who did not ( $p=0.18$ ). Univariate analysis was performed for selected risk factor such as age, sex and duration of glaucomatous process as predictors of final visual acuity and odds ratio with 95% confidence intervals were calculated. Patients with age more than 60 years and in

whom glaucoma was present for more than 5 days had a significantly higher risk of poor visual outcome post operatively.

### 3. VISUAL OUTCOME IN LENS INDUCED GLAUCOMAS

(Dr. V. Velayutham, Dr. T. Nirmal Fredrik, Dr.V. Nagarathinam, Dr.P.R. Sankari, TNOA, March 1996)

A total number of 240 eyes who attended the glaucoma clinic in RIO GOH and were analysed and among them 100 cases were phacomorphic and 140 cases were phacolytic.

The results of the study

F : M ratio 2 : 1

Higher incidence of phacolytic

Mean IOP 44 mm Hg (Schiotz)

Strong correlation between duration of attack and preoperative and post operative visual acuity. Pre operative faulty projection of light need not defer definitive cataract surgery.



## **PATIENTS AND METHODS**

This study was done in 60 eyes of 60 patients who attended Govt. Rajaji Hospital, Madurai during the period from January 2006 – June 2007.

This was a prospective, randomized and comparative type of study.

All consecutive patients diagnosed as Lens induced Glaucomas on the basis of clinical symptoms and signs were included.

Clinical features included pain, loss of vision, redness of the eye, presence of an intumescent, mature or hypermature cataract associated with raised intraocular pressure (IOP) of more than 21 mm Hg.

A detailed clinical examination included the status of the lens and the anterior chamber depth of the other eye assessed by slit lamp biomicroscopy, tonometry by Schiotz tonometer and gonioscopy of the fellow phakic eye. The depth of the anterior chamber was assessed by directing the slit lamp beam adjacent to the limbus and the anterior chamber was considered to be shallow if the depth was less than  $\frac{1}{4}$  of corneal thickness.

Phacomorphic glaucomas were recognized by the subjective complaints of pain and redness associated with the presence of corneal edema, shallow anterior chamber, an intumescent cataractous lens and intra ocular pressure above 21 mm Hg. Pre operative measures to decrease intra ocular pressure included topical application of timolol maleate 0.5% twice daily, supplemented with oral acetazolamide 250 mg three times a day and oral glycerol 50% 10z twice a day. Mannitol 200 ml of 20% was given intravenously just before surgery for a period of thirty minutes.

Phacolytic glaucomas were diagnosed by the presence of pain, corneal edema, a normal or deep anterior chamber containing floating lens particles and / or pseudo hypopyon in severe cases and the presence of a white hypermature morgagnian cataractous lens. The attempt to control intra ocular pressure in these cases was made by the topical application of betamethazone 0.1% eye drops six times a day, timolol 0.5% eye drops twice a day and atropine 1% eye ointment twice a day, supplemented with oral acetazolamide 250 mg four times a day. The intraocular pressure was then measured by Schiotz

tonometry to assess the change following these hypotensive medications.

Among the 60 patients, 30 patients underwent combined surgery ie, cataract surgery with trabeculectomy and 30 patients underwent simple cataract surgery. The decision for combined surgery was based on the duration of presentation, IOP control after medical treatment.

Intraocular lens was implanted in all patients except in few cases. The surgery was done under local anesthesia in all the cases.

After surgery patients were kept in the hospital for a post operative period of three days. Topical medication comprising of a combination of antibiotics and steroids was applied six times a day. A short acting cycloplegic was used if and when necessary – the main objective being prevention of posterior synechiae formation. They were then discharged with instructions to use a topical antibiotic steroid combination for a period of 6 weeks.

### **Review :**

The patients were reviewed after one month and three months. Best corrected visual acuity, slit lamp examination, Schiötz tonometry and fundus examination was done.

## PROFORMA

Name :

Age :

Sex :

Address :

MRD No. :

Study No. :

Ocular Examination :

- |                         |    |              |
|-------------------------|----|--------------|
| Type of glaucoma        | 1. | Phacomorphic |
|                         | 2. | Phacolytic   |
| Laterality              | 1. | R.E          |
|                         | 2. | L.E          |
| History of Medication : | 1  | Nil          |
|                         | 2. | Timolol      |
|                         | 3. | Diamox       |
|                         | 4. | Others       |

If yes Duration

- | Defective Vision | Pain | Redness |
|------------------|------|---------|
| 1. 5-10 days     |      |         |
| 2. 11-21 days    |      |         |
| 3. 21-30 days    |      |         |
| 4. > 30 days     |      |         |

Preoperative BCVA

Preoperative IOP

Slip lamp examination :

Conjunctiva : 1. Normal 2. Circum corneal congestion 3. Others

Cornea : 1. Clear 2. Edema 3. Pigmentation 4. PXF 5. Others

AC Depth : 1. Normal 2. Deep 3. Shallow

AC reaction : 1. Mild flare 2. Moderate flare 3. Severe 4. Fibrinous

Iris : 1.Normal 2. Neovascularized 3. others  
Lens : 1. Intumescent 2. Hypermature 3. mature 4. Phacodonesis  
5. others

Gonioscopy : 1. Too hazy to view 2. Closed 3. Narrow 4. Open  
Other eye lens status : 1. Clear lens 2. Immature cataract 3. mature cataract  
4. IOL 5. Aphakia 6. Others

Gonioscopy of the other eye : 1. Open 2. Narrow 3. Closed 4. Others

Optic nerve head of other eye : 1. Normal 2. Glaucomatone 3. Others

Date of surgery :

Date Month Year

Type of surgery :

1. ECCE 2. ECCE + IOL 3. Combined surgery

Intraoperative Complications :

1. Descemets membrane stripping
2. Button holing of conjunctiva
3. Posterior capsular rupture
4. Zonular dialysis
5. Vitreous loss
6. Failure to implant IOL
7. Excessive bleeding
8. Others

Post operative examination - 24 hrs

Conjunctiva : 1. Bleb 2. wound leak 3. Flat bleb

Cornea : 1. Clear 2. Edema 3. SK

AC : 1. Normal 2. Shallow 3. Hyphema 4. Hypopyon  
5. Vitreous

AC Reaction : 1. Fibrin membrane 2. 3+cells 3. < 3+ cells

Iridectomy : 1. Peripheral iridectomy 2. Sector iridectomy  
Iritis : 1. Mild 2. Moderate 3. Severe 4. Nil  
Pupil : 1. Normal 2. Peaked 3. Sphincterectomy  
Lens : 1. Insitu 2. Decentered IOL 3. PCO

Specific post operative complications :

1 - Corneal edema 2 - Uveitis 3 - IOL decentration 4. Vitreous loss  
5 - Residual cortex 6 - PC rent 7- hyphema 8. endophthalmitis  
9 - Others, 10 - Nil

BCVA

IOP

Optic Nerve head changes : 1. Normal 2. Pale  
3. Glaucomatous 4. GOA

Post operative Examination : 1 month 3 months

Conjunctiva (Bleb) 1. Good 2. Flat

Cornea 1. Edema 2. Others

AC 1. Normal 2. Shallow 3. Others

Iris 1. Persistent Uveitis 2. others

Pupil 1. Pupillary capture 2. Synechiae

Lens 1. Insitu 2. Decentered 3. PCO

BCVA

IOP

Fundus :

C : D Ratio

Posterior pole changes

## RESULTS

### Magnitude and Classification :

Out of 60 patients of Lens induced Glaucoma phacomorphic glaucoma was present in 36 patients (60%) and phacolytic glaucoma in 24 patients (40 %)

**Table – 1**

Type of Glaucoma	Frequency	Percentage
Phacomorphic glaucoma	36	60%
Phacolytic glaucoma	24	40%
Total	60	100

### Age :

The age range in both types of Lens induced Glaucoma was 40-80 years with 40% of cases occurring in patients aged under 60 years of age.

Age Distribution	Percentage
40-50 years	5 %
51-60 years	35%
61-70 years	40 %
71-80 years	20%

### Sex Distribution :

There was a slight female preponderance (58.33%) compared to male population (41.66%)

**Table – 3**

Sex	Frequency	Percentage
Male	25	41.66%
Female	35	58.33%
Total	60	100

**Laterality :**

66.67% of the study group showed involvement of right eye compared to 33.33% which showed involvement of left eye.

**Table – 4**

	Frequency	Percentage
RE	40	66.67%
LE	20	33.33%
Total	60	100

**Presentation :**

Pain of more than 10 days duration in the affected eye was the chief presentation in 72% of cases

**PAIN :**

**Table – 5**

Duration	Frequency	Percentage
5-10 days	17	28.33%
11-20 days	20	33.33%
21-30 days	13	21.66%
> 30 days	10	16.66%
Total	60	100



## Defective Vision

**Table – 6**

	Frequency	Percentage
5 – 10 days	5	8.3
11-20 days	10	16.66
21-30 days	20	33.33
> 30 days	25	41.66
Total	60	100

Maximum number of patients presented with symptoms of defective vision of more than 30 days and symptoms of pain of 11-20 days.

### **Visual Acuity in the affected eye :**

Patients were grouped either as having accurate or inaccurate projection of light rays.

**Table – 7**

	Frequency	Percentage
Accurate PR	34	56.66%
Inaccurate PR	26	43.33%
Total	60	100

### **Pupils :**

Pupil examinations was done in a dark room and pupil function was categorized as follows.

**Table – 8**

	Frequency	Percentage
Acting	16	26.67
Not Acting	44	67.50
Total	60	100

**Preoperative IOP levels :**

Patients presents with following preoperative IOP

**Table – 9**

IOP in mm Hg	Frequency	Percentage
20 – 25	2	3.33
26-30	4	6.67
31-35	5	8.33
36-40	6	10%
41-45	10	16.67
46-50	20	33.33
> 50	13	21.66
Total	60	100

The IOP ranged from 20 to more than 50 mm Hg. Maximum number of eyes had an IOP of more than 45 mm Hg.

**Other eye lens status :**

**Table – 10**

Lens Status	Frequency	Percentage
Clear lens	4	6.67
IMC	25	41.66
MC	5	8.33
Aphakia	16	23.33
IOL	12	20
Total	60	100

Maximum number of patients had Immature cataract in the other eye.

### Other eye Visual Acuity

**Table – 11**

Visual Acuity	Frequency	Percentage
6/6 – 6/60	30	50%
6/60 – 3/60	20	33.33%
< 3/60	10	16.66%
Total	60	100

Examination by subgroups

### Phacomorphic patients – Other eye status :

**Table – 12**

Lens Status	Frequency	Percentage
Clear lens	2	5.5
IMC	20	55.55
MC	2	5.5
Aphakia	6	16.67
IOL	6	16.67
Total	36	100

Phacolytic Patients – Other eye status

**Table – 13**

Lens Status	Frequency	Percentage
Clear lens	2	8.3
IMC	5	20.83
MC	3	12.50
Aphakia	10	41.66
IOL	4	16.66
Total	24	100

In case of phacomorphic glaucomas 55.55% of fellow eye showed immature cataracts

In phacolytic patients majority of the fellow eye was aphakia 41.66%

Comparison between angle width in phacomorphic glaucoma cases of fellow eye.

**Table – 14**

	Frequency	Percentage
AC shallow	14	58.33
AC – Normal depth	10	41.66
Total	24	100

None of the fellow phakic eyes of phacolytic glaucomas had shallow anterior chamber and all those eyes had a wide open angle by gonioscopy.

Comparison between the type of surgery performed based on subgroup

**Table - 15**

Type of surgery	Phacomorphic		Phacolytic	
	Frequency	Percentage	Frequency	Percentage
ECCE only	3	8.3	2	8.3
ECCE with PCIOL	11	30.55	11	45.83
Combined	20	55.55	10	41.66
ECCE with ACIOL	2	5.5	1	4.1
Total	36	100	24	100

In phacomorphic group maximum number of patients had combined surgery (55.55%) compared to 41.66% in phacolytic group.

**Table – 16**  
**Intraoperative and postoperative complications**

Complications	Phacomorphic		Phacolytic	
	Frequency	Percentage	Frequency	Percentage
DM stripping	5	13.88	3	13
Posterior capsular rupture	5	13.88	4	16.67
Zonular dialysis	5	13.88	4	16.67
Vitreous loss	7	19.44	3	12.5
Hyphema	3	8.3	2	8.3
Iritis	25	69	18	75
Pupillary block glaucoma	2	5.5	0	0
Shallowing of AC	8	22.22	0	0

**Complications were more in lens induced glaucoma**

**BCVA at last follow up by subgroup**

**Table - 17**

Visual Acuity	Phacomorphic		Phacolytic	
	Frequency	Percentage	Frequency	Percentage
6/6 – 6/12	20	55.55	14	58.33
6/18 – 6/60	10	27.77	6	25
< 6/60	6	16.66	4	16.66
Total	36	100	24	100

BCVA in both phacolytic and phacomorphic groups was 6/6 – 6/12 in more than 50% of cases

**Table – 18**

**Comparison between type of surgery and visual acuity**

Type of surgery	Final Visual Acuity			Total
	6/6 - 6/12	6/18 – 6/60	< 6/60	
Simple cataract surgery	18 (60%)	7 (23.33%)	5 (16.66%)	30
Combined surgery	16 (53.33%)	9 (30%)	5 (16.67%)	30
Total	34 (56.67%)	16 (26.67%)	10 (16.67%)	60

Visual acuity between simple cataract surgery and combined surgery does not show any significant difference.

**Table - 19**

**Comparison between IOP in 60 eyes with Lens induced glaucoma**

IOP in mmHg	At presentation		After preoperative control with drugs		At discharge	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
0 - 20	3	5%	34	56.67	45	75
21 – 30	5	8.33	12	20	8	13.33
31 – 40	14	23.33	10	16.67	5	8.33
> 40	38	63.33	4	6.67	2	3.33
Total	60	100	60	100	60	100

At presentation more than 60% had IOP above 40 mm Hg. After treatment with drugs only 6% had IOP above 40 mm Hg.

After surgery 75% had IOP < 20 mm Hg.

**Table - 20**

**Comparison between BCVA at last follow up by preoperative IOP**

Post operative Visual acuity	Preoperative < 35 mm Hg		IOP > 35 mm Hg	
	Frequency	Percentage	Frequency	Percentage
6/6 – 6/12	5	38.46	29	61
6/18 – 6/60	5	38.46	11	23
< 6/60	3	23.07	7	14.89
Total	13	100	47	100

There was no significant difference between good visual acuity and preoperative IOP.

**Table – 21**

**Relation between duration in days with post operative Visual Acuity**

Duration of pain in days	Post operative Visual Acuity		
	6/6 - 6/12	6/18 – 6/60	< 6/60
5 – 10 days	15 (25%)	2 (3.3%)	0
11 – 20 days	13 (21.67%)	6 (10%)	1 (1.6%)
21-30 days	5 (8.3%)	4 (6.6%)	4 (6.6%)
> 30 days	1 (1.6%)	4 (6.6%)	5 (8.3%)

25% of patients who presented with in 5-10 days have a visual acuity of more than 6/12. But those who presented more than 30 days after only 1.6% had good visual acuity.

Cause of poor post operative visual acuity in 10 eyes

**Visual Acuity < 6/60 is considered as poor visual acuity**

Cause	Frequency	Percentage
Optic Atrophy	3	30%
Uveitis	2	20%
Corneal edema	2	20%
Retinal detachment	1	10%
Vitreous Haemorrhage	2	20%
Total	10	100%

Out of the total 60 patients 10 patients had poor visual acuity. Out of this 30% had optic atrophy, 20% had uveitis, 20% had corneal oedema and retinal detachment (10%) and vitreous haemorrhage was present in 20% of patients.



## DISCUSSION

Lens induced glaucomas are a common occurrence in India, hardly surprising in a situation where the incident of cataract cases far exceeds the total number of surgeries performed currently. Though these are clinically distinct entities, they have certain common factors in that they are lens induced, they compromise the function of the optic nerve due to rise of intraocular pressure, cataract surgery is curative in these cases, and finally they uniformly share a guarded prognosis.

This study was undertaken to outline the different characteristics of glaucomas, to determine the post operative visual results following simple cataract extraction of combined surgery and to evaluate any risk factors which may play a role in the determination of final post operative visual acuity.

Study was done in 60 eyes with lens induced glaucomas.

In our study phacomorphic glaucoma was slightly more common (36 eyes ; 60%) than phacolytic glaucoma (24 eyes ; 40%). Study done in Nepal showed 72% of phacomorphic glaucoma and 28% of phacolytic. Prajna et al found more or less equal numbers in their

series. Velayutham et al in their study reported more number of phacolytic than phacomorphic cases.

The age range for both types of lens induced Glaucomas in this series was 40-80 years with 40% of the cases occurring in patients under the age of 60. More than 60% occurred in patients more than 60. Findings were consistent with study from Nepal and study at Aravind Eye hospital.

Study of GOH reported 99% of cases were in the age group between 51-60. Lens induced Glaucomas was more common in females. (35 eyes ; 58.33%) compared to males (25 eyes ; 41.66%)

In all studies females seemed to have significant increased risk of having these glaucomas. Thought it is possible that these entities are more common in females because of socio economic constraints, we also have to consider the fact that the prevalence of cataract itself is more common in females than males.

Pain of more than 10 days duration was the presentation in 72% of cases. Pain of 11-20 days was present in 33.33% cases, 16.66% presented with pain more than 30 days duration 41.66% patients presented with defective vision of more than 30 days.

The IOP at presentation ranged from 20 to more than 50 mm Hg. Maximum numbers of patients had an IOP of more than 45 mm Hg.

We also documented the status of the lens in the fellow eyes of these patients to see if there was any difference between the subgroups.

Out of the 60 patients majority 41.66% had immature cataract in the other eye, 23.33% had aphakia, 20% had other eye IOL, 8.33% had mature cataract and 6.67 % had clear lens in the other eye.

However examination by subgroups revealed that in cases with phacomorphic glaucomas the status of the fellow eye was predominantly immature cataracts (about 55%) while aphakia contributed (16.67%). Analysis of the fellow eyes of patients with phacolytic glaucoma showed that 41.66% of cases showed aphakia and immature cataracts contributed to about 20% of cases.

Fifty eight percent of the fellow phakic eye of phacomorphic had shallow anterior chamber. None of the fellow phakic eyes of phacolytic glaucomas had shallow anterior chamber.

50% of the other eye out of 60 patients had good visual acuity of more than 6/60.

## **RESULTS OF SURGERY**

Out of the 36 patients with phacomorphic glaucoma 20 patients (55.55%) underwent combined surgery, 11(30.55%) had ECCE with PCIOL. 3 patients ECCE only (8.33%) and 2 (5.5%) patients had ECCE with ACIOL.

In case of phacolytic glaucoma out of 24 patients 11 patients (45.83%) had ECCE with PCIOL, 10 patients (41.66%) had combined surgery, 2(8.3%) had ECCE only and 1 (4.1%) underwent ECCE with ACIOL.

In the Nepal study all cases underwent scleral tunnel sutureless cataract surgery

In the study by Prajana et al done at Aravind Eye hospital all the 93 patients underwent planned extra capsular cataract extraction (ECCE).

Intra operative and post operative complication were more in lens induced glaucomas compared to other types.

There is no significant difference in the incidence of intraoperative and post operative complications between phacolytic and phacomorphic glaucoma. The post operative period was more

stormy in these cases and they were managed by more frequent application of topical steroids and antibiotics.

In our study 69% of patients with phacomorphic glaucoma and 75% of patients with phacolytic glaucoma had iritis.

Posterior capsular rupture was present in 13.88% of phacomorphic glaucoma and 16.67% of phacolytic glaucoma ; zonular dialysis was present in 13.88% of phacomorphic glaucoma and 16.67% of phacolytic, glaucoma. Vitreous loss was present in 19.44% of phacomorphic glaucoma and 12.5% of phacolytic glaucoma.

Pupillary block glaucoma was present in 5.5% of cases of phacomorphic glaucoma. None of the cases of phacolytic glaucoma had this complication. Shallowing of anterior chamber due to positive vitreous pressure was present in 22.22%. Descemets membrane stripping, hyphema were equal in phacomorphic and phacolytic glaucomas 13% and 8.3% respectively.

Study of Prajana et al also showed a similar incidence of complications with iritis in more than 80% of cases. Positive vitreous pressure in 24% of cases of phacomorphic glaucoma hyphema in 8% of cases of phacomorphic glaucoma.

Nepal study also showed increased incidence of subluxation of lens and post operative inflammation which were more in phacolytic glaucoma.

Follow up of the patients were done at one month and 3 months post operatively. The visual acuity at the last follow up was taken as the post operative visual acuity. A corrected visual acuity of 6/12 or better was taken as good visual acuity and accordingly 55.55% of phacomorphic glaucomas and 58.33% of phacolytic glaucomas recovered to a good visual acuity. Six patients (16.66%) with phacomorphic and 4 patients (16.66%) with phacolytic glaucoma had poor visual recovery ( $< 6/60$ ). There was no significant difference between the two groups on final post operative visual recovery.

In the Nepal study 31.4% eyes achieved 6/18 or better with best correction 21% with visual acuity of less than 3/60.

In the study by Prajana et al 57% of phacomorphic and 61% of phacolytic glaucomas had good visual acuity. 10.2% with phacomorphic and 13.6 % with phacolytic glaucoma had poor visual acuity.

Out of the total 60 cases in 30 cases simple cataract surgery was done in rest 30 cases combined surgery was done.

Good visual acuity of more than 6/12 was seen in 60% cases with simple cataract surgery and 53.3% cases with combined surgery.

Visual acuity of less than 6/60 was seen on 16.67% of simple cataract surgery and combined surgery.

In the case of phacomorphic glaucoma 55.55% had combined surgery compared to 41.66% in cases of phacolytic glaucoma. The increased incidence of combined surgery in phacomorphic glaucoma is due to gonioscopic evidence of angle closure and extensive peripheral anterior synechiae due to longer duration of attack.

Combined surgery in our cases did not provide significant advantage over simple cataract surgery in the management of Lens induced glaucoma.

The total preoperative intraocular pressure range from 20- > 40 mmHg. At presentation more than 60% had IOP above 40 mm Hg. After the administration of hypotensive drugs only 6% had IOP above 40 mm Hg. After surgery more than 75% had intra ocular pressure less than 20mmHg.

In our analysis there was no relationship between height of Intra ocular pressure and final visual acuity.

Out of 13 patients who had IOP less than 35 mm Hg, 38.46% had good visual acuity. 61% of the patients had good visual acuity out of the 47 patients who had intra ocular pressure more than 35mm Hg.

Similar results were obtained in the study of velayutham et al and study by Prajana et al which showed that there was no statistically significant difference on the attainment of good post operative visual acuity and preoperative IOP.

In our study, we found a strong correlation between the duration of attack and final visual acuity. Those patients who presented with in 5-10 days of attack 25% had good visual acuity of more than 6/12.

Those who presented with in 20 days 21.67% had good visual acuity. But those who presented late ie. More than 30 days only 1.6% had good visual acuity and 8.3% had low visual acuity of less than 6/60. Among those who presented within 5-10 days no patients had visual acuity less than 6/60.

The results of this study were similar to study by Velayutham et al which concluded that the final visual prognosis is directly



proportional to the duration of attack rather than the type of cataract and modality of surgery.

Among the 60 patients 10 had visual acuity less than  $< 6/60$ . 30% of patients had optic atrophy. 20% of patients had uveitis, corneal oedema and vitreous haemorrhage.

In the study by Prajana et al also 23% of cases had poor visual acuity less than 6/60. Causes included glaucomatous optic atrophy, severe persistent post operative uveitis and resultant cystoid changes in the macula.

In our study 43.33% had inaccurate projection of light but only 16.67% had visual acuity less than 6/60 post operatively. So faulty projection of light preoperatively doesn't mean surgery should be deferred. Also in one study pupils were not acting in 67% of cases. We found that undue importance of pupillary reaction cannot be given to predict post operative intra ocular pressure control and final visual recovery. The reason for the pupils not reacting on presentation may be due to the mechanical stretching due to intumescent lens and not necessarily due to a compromised optic nerve.

## CONCLUSION

In our study mean age of presentation is 60 years

Female : Male ratio is 1.4 : 1

Higher incidence of phacomorphic than phacolytic glaucoma

There is no relation between final visual acuity and type of surgery.

Increased incidence of complications in both groups.

Visual prognosis is almost similar in both groups after surgery

Post operative visual status and duration of attack had significant association and not the height of IOP.

Preoperative faulty projection of light need not defer definitive cataract surgery.

These results highlight the importance of early diagnosis and treatment of mature cataract. There is a need to educate both the patients and the cataract surgeon of the dangers of lens induced. Glaucoma and of the poor outcome if treatment is delayed.

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**PHACOMORPHIC GLAUCOMA**

**PHACOLYTIC GLAUCOMA**

**LENS PARTICLE GLAUCOMA**

**HISTOLOGY OF PHACOLYTIC GLAUCOMA**

**GLAUCOMA FILTRATION PROCEDURE**

**(TRABECULECTOMY)**

**TRABECULECTOMY SHOWING BLEB**

**PHACOLYTIC GLAUCOMA PATHOLOGY**

**SUBLUXATED LENS**

**PHACO ANAPHYLACTIC GLAUCOMA**

## MASTER CHART

S. No.	Name	Sex	Age	IP No.	Type of Glaucoma	Symptoms		Pre op BC VA	Pre op IOP	Preop. Examination		Other eye lens status	Gonio other eye	Type of Sx	Post op. BC VA	Post Op. IOP mmHg
						Pain days	DV-days			AC depth	Lens					
1	Mundiammal	F	55	140102	PM	5-10	5-10	PR+	33	Shallow	Intu	IMC	Closed	Combined	6/9	20.6
2	Balamani	F	58	140548	PM	5-10	11-20	PR+	45.8	Shallow	Intu	IMC	Closed	ECCE with PCIOL	6/36	22.4
3	Eswari	F	65	140308	PL	11-20	11-20	PR-	26.6	Deep	HMC	IMC	Open	ECCE with PCIOL	6/12	18.9
4	Ayyavu	M	75	28533	PL	11-20	5-10	PR+	54.7	Deep	MC	Aphakia	Open	Combined	6/12	22.4
5	Periyakarupan	M	78	28275	PM	>30	21-30	PR+	49.8	Shallow	Intu	MC	Open	Combined	5/60	29.0
6	Meenammal	F	62	140306	PL	5-10	5-10	PR+	21.9	Deep	MC	IMC	Open	ECCE with PCIOL	6/9	14.6
7	Maruthaya	F	49	30150	PM	11-20	5-10	PR+	23.8	Shallow	Intu	IMC	Open	ECCE with PCIOL	6/24	17.3
8	Pitchaiammal	F	72	140333	PM	11-20	5-10	PR-	27.4	Shallow	Intu	IMC	Shallow	ECCE with PCIOL	6/36	20.6
9	Kannammal	F	54	140384	PM	21-30	5-10	PR+	42.1	Shallow	Intu	IMC	Shallow	Combined	6/9	18.9

1 0 .	Karuppaiya	M	51	140256	PM	21-30	11-20	PR+	45.8	Shallow	Intu	IMC	Shallow	Combined	6/9	14.6
1 1 .	Chinnammal	F	57	30403	PM	>30	11-20	PR-	49.8	Shallow	Intu	Clearlen	Open	Combined	6/24	23.8
1 2 .	Valli	F	76	27116	PL	5-10	5-10	PR+	29	Deep	HMC	IMC	Open	ECCE only	6/12	20.6
1 3 .	Gurusamy	M	75	30147	PL	21-30	11-20	PR+	46.9	Deep	MC	Aphakia	Open	Combined	6/12	18.9
1 4 .	Perumayee	F	71	35412	PL	21-30	21-30	PR-	59.1	Deep	HMC	Aphakia	Open	ECCE with PCIOL	6/9	12.2
1 5 .	Krishnammal	F	80	32083	PL	5-10	5-10	PR+	29.0	Deep	HMC	Aphakia	Open	ECCE with PCIOL	6/9	16.5
1 6 .	Periyasamy	M	62	35508	PM	>30	>30	PR-	49.8	Shallow	Intu	IOL	Open	Combined	6/36	18.5



1 7 .	Vellayammal	F	52	30149	PM	21-30	11-20	PR+	46.9	Shallow	Intu	Aphakia	Open	Combined	6/12	18.9
1 8 .	Poochammal	F	55	28311	PM	21-30	11-20	PR+	75.1	Shallow	Intu	IMC	Shallow	Combined	6/9	18.9
1 9 .	Muthumari	F	55	34431	PM	21-30	5-10	PR+	42.1	Shallow	Intu	IMC	Shallow	Combined	6/9	20.6
2 0 .	Duraisamy	M	63	30150	PL	>30	21-30	PR-	54.7	Deep	MC	Aphakia	Open	combined	5/60	34.5
2 1 .	Pappu	F	78	34887	PL	11-20	21-30	PR-	34.4	Deep	HMC	MC	Open	ECCE with PCIOL	6/9	12
2 2 .	Vellaisamy	M	64	14507	PL	>30	21-30	PR-	59.1	Deep	HMC	Aphakia	Open	ECCE with PCIOL	6/60	18.9
2 3 .	Muthu	F	77	140379	PL	11-20	21-30	PR+	37.8	Deep	MC	IMC	Open	Combined	6/9	20.6

2 4 .	Kaliappan	M	61	140280	PM	>30	>30	PR+	49.8	Shallow	Intu	IMC	Shallow	ECCE with PCIOL	6/36	17.3
2 5 .	Subbulakshmi	F	53	140215	PM	21-30	11-20	PR-	49.8	Shallow	Intu	Clearlens	Open	ECCE with PCIOL	6/36	22.4
2 6 .	Veerammal	F	58	140524	PM	21-30	>30	PR-	42.1	Shallow	Intu	IMC	Shallow	ECCE with PCIOL	6/12	20.6
2 7 .	Gandhiammal	F	59	140936	PM	>30	11-20	PR-	46.9	Shallow	Intu	MC	Open	Combined	6/9	25.0
2 8 .	Nagammal	F	65	5402	PL	>30	>30	PR-	46.9	Deep	MC	IOL	Open	ECCE with PCIOL	6/12	12.2
2 9 .	Chellammal	F	79	30142	PL	11-20	>30	PR-	37.6	Deep	MC	Clearlens	Open	combined	6/12	14.6
3 0 .	Nagammal	F	65	7095	PL	>30	>30	PR-	45.8	Deep	MC	IOL	Open	ECCE with PCIOL	6/12	12
3 1 .	Thangammal	F	62	30404	PM	>30	11-20	PR-	75.1	Shallow	Intu	IMC	Open	ECCE with PCIOL	6/9	26.6

3 2 .	Mookusamy	M	54	7044	PM	21-30	11-20	PR-	69.3	Shallow	Intu	IMC	Shallow	Combined	6/9	14.6
3 3 .	Veeranar	M	70	20423	PM	>30	>30	PR+	69.3	Shallow	Intu	IMC	Open	Combined	4/60	49.8
3 4 .	Andi	M	74	15354	PL	21-30	11-20	PR-	46.9	Deep	MC	MC	Open	ECCE with PCIOL	6/12	16.5
3 5 .	Saraswathi	F	74	15235	PM	11-20	5-10	PR+	31.6	Shallow	Intu	IOL	Open	ECCE with PCIOL	6/12	20.6
3 6 .	Veeran	M	52	20035	PM	21-30	5-10	PR+	37.8	Shallow	Intu	IMC	Shallow	ECCE with PCIOL	6/9	12.0
3 7 .	Kandasamy	M	73	15750	PL	21-30	11-20	PR-	46.9	Deep	HMC	IOL	Open	Combined	6/9	14.6
3 8 .	Alagi	F	66	22748	PL	>30	>30	PR+	46.9	Deep	HMC	Aphakia	Open	Combined	6/60	11.2

3 9 .	Chinnaponnu	F	61	17708	PM	>30	11-20	PR-	69.3	Shallow	Intu	Aphakia	Open	ECCE with PCIOL	6/12	17.3
4 0 .	Saurabeevi	F	63	19040	PM	>30	21-30	PR-	42.1	Shallow	Intu	IMC	Shallow	Combined	6/9	18.9
4 1 .	Petchi	F	67	22769	PL	>30	>30	PR+	69.3	Deep	HMC	Aphakia	Open	ECCE with PCIOL	4/60	34.5
4 2 .	Arumugam	M	76	19056	PL	21-30	11-20	PR+	37.8	Deep	HMC	IOL	Open	ECCE with PCIOL	4/60	38.8
4 3 .	Lakshmi	F	68	30776	PL	>30	>30	PR-	81.7	Deep	HMC	MC	Open	ECCE with PCIOL	6/60	20.6
4 4 .	Mariappan	M	64	32081	PM	>30	21-30	PR+	45.8	Deep	Intu	IMC	Open	Combined	6/12	20.6
4 5 .	Ganesan	M	56	33766	PM	21-30	11-20	PR+	49.8	Shallow	Intu	IMC	Open	Combined	6/12	15.9
4 6 .	Krishnan	M	65	20834	PM	>30	21-30	PR+	69.3	Shallow	Intu	IMC	Shallow	ECCE with PCIOL	6/36	15.9

4 7 .	Alagammal	F	59	22720	PM	21-30	5-10	PR-	45.8	Shallow	Intu	Aphakia	Open	Combined	6/9	14.6
4 8 .	Muthiya	M	67	208411	PM	>30	>30	PR+	46.9	Shallow	Intu	Aphakia	Open	Combined	4/60	49.8
4 9 .	Ganapathy	M	45	32077	PM	11-20	5-10	PR-	33.0	Shallow	Intu	IOL	Open	Combined	6/12	18.9
5 0 .	Abdulkhaddar	M	43	33758	PM	11-20	5-10	PR+	37.8	Shallow	Intu	IMC	Open	ECCE with PCIOL	6/9	17.3
5 1 .	Karuppayee	F	60	28798	PM	21-30	5-10	PR-	45.8	Shallow	Intu	aphakia	Open	ECCE with PCIOL	6/9	17.3
5 2 .	Ayyappan	M	68	24451	PM	>30	>30	PR+	42.1	Shallow	Intu	IOL	Open	Combined	5/60	31.6
5 3 .	Pidaram	M	57	140196	PM	21-30	11-20	PR+	49.8	Shallow	Intu	IOL	Open	ECCE with PCIOL	4/60	20.6

5 4 .	Murugesan	M	72	140996	PL	21-30	11-20	PR-	45.8	Deep	HMC	Aphakia	Open	Combined	6/12	12.0
5 5 .	Vellathai	F	69	33777	PL	>30	21-30	PR-	42.1	Deep	MC	Aphakia	Open	ECCE with PCIOL	6/24	29.0
5 6 .	Muniyammal	F	55	31265	PM	21-30	11-20	PR-	42.1	Shallow	Intu	IMC	shallow	Combined	6/36	18.9
5 7 .	Dhanalakshmi	F	64	31862	PL	>30	21-30	PR+	45.8	Deep	HMC	IMC	Open	Combined	5/60	18.0
5 8 .	Chinakarupan	M	56	32879	PM	21-30	11-20	PR+	69.3	Shallow	Intu	IOL	Open	ECCE with PCIOL	6/24	18.9
5 9 .	Ramayee	F	70	35109	PM	>30	21-30	PR+	45.8	Deep	HMC	IOL	Open	Combined	6/36	14.6
6 0 .	Muthulakshmi	F	63	16490	PL	>30	21-30	PR+	46.9	Deep	HMC	Clear lens	Open	ECCE only	6/24	15.9

## ABBREVIATIONS

PM - Phacomorphic glaucoma

PR - Projection of Light

Intu - Intumescent cataract

IMC - Immature cataract

PL - Phacolytic glaucoma

HMC- Hypermature cataract

MC - Mature cataract

IOL - Intra Ocular Lens