

*Dissertation on*

**VISUAL OUTCOME AND INTRAOCULAR PRESSURE  
CONTROL IN LENS INDUCED GLAUCOMAS  
FOLLOWING SURGERY**

*Submitted in partial fulfillment of requirements of*

**M.S. OPHTHALMOLOGY  
BRANCH - III**

**REGIONAL INSTITUTE OF OPHTHALMOLOGY  
MADRAS MEDICAL COLLEGE  
CHENNAI- 600 003**



**THE TAMILNADU  
DR.M.G.R. MEDICAL UNIVERSITY  
CHENNAI**

**APRIL 2017**

## **CERTIFICATE**

This is to certify that this dissertation entitled “**VISUAL OUTCOME AND INTRAOCULAR PRESSURE CONTROL IN LENS INDUCED GLAUCOMAS FOLLOWING SURGERY**” is a bonafide record of the research work done by **Dr. D.V.SARANYA** , post graduate in Regional Institute of Ophthalmology and Government Ophthalmic Hospital, Madras Medical College and Government General Hospital, Chennai-03, in partial fulfillment of the regulations laid down by The Tamil Nadu Dr. M.G.R. Medical University for the award of M.S. Ophthalmology Branch III, under my guidance and supervision during the academic years 2014-2017.

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I wish to express my sincere thanks to my father and mother and to  
all my senior post graduates and colleagues who had helped me in  
bringing out this study.

**INSTITUTIONAL ETHICS COMMITTEE  
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**CERTIFICATE OF APPROVAL**

To  
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Post Graduate in M.S. Ophthalmology  
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Dear Dr.D.V.Saranya,

The Institutional Ethics Committee has considered your request and approved your study titled **"VISUAL OUTCOME AND INTRAOCULAR PRESSURE CONTROL IN LENS INDUCED GLAUCOMAS FOLLOWING SURGERY"- NO. 17042016.**

The following members of Ethics Committee were present in the meeting hold on **05.04.2016** conducted at Madras Medical College, Chennai 3

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| 13.Tmt.Arnold Saulina, MA.,MSW.,                          | :Social Scientist  |

We approve the proposal to be conducted in its presented form.

The Institutional Ethics Committee expects to be informed about the progress of the study and SAE occurring in the course of the study, any changes in the protocol and patients information/informed consent and asks to be provided a copy of the final report.

Member Secretary - Ethics Committee

  
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**VISUAL OUTCOME AND INTRAOCULAR PRESSURE CONTROL IN LENS**



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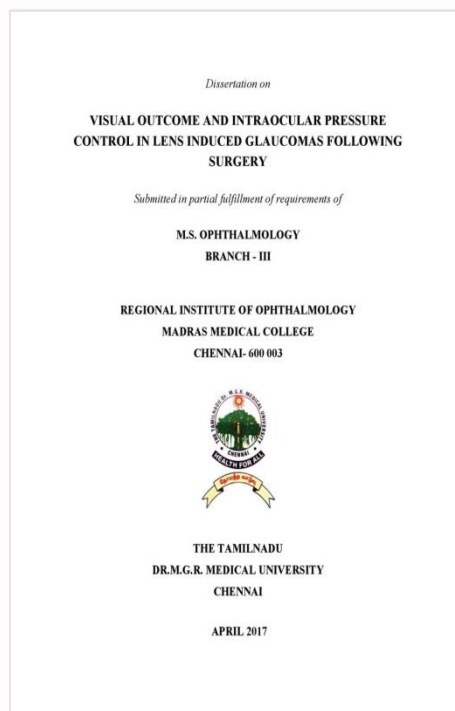


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## **DECLARATION BY THE CANDIDATE**

I hereby declare that this dissertation entitled “**VISUAL OUTCOME AND INTRAOCULAR PRESSURE CONTROL IN LENS INDUCED GLAUCOMAS FOLLOWING SURGERY**” is a bonafide and genuine research work carried out by me under the guidance of Prof.Dr.P.S.Maheswari.

DATE:

**DR.D.V.SARANYA**

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## INTRODUCTION

Glaucoma is a leading cause for blindness in the developing countries. It is a preventable cause of blindness and hence it is important to create an awareness about this condition.

Congenital, juvenile, primary glaucoma and secondary glaucoma are the broad classification of glaucomas. There are various types of secondary glaucomas like post inflammatory, angle recession, pseudo exfoliation, pigmentary glaucoma and lens induced glaucoma etc.

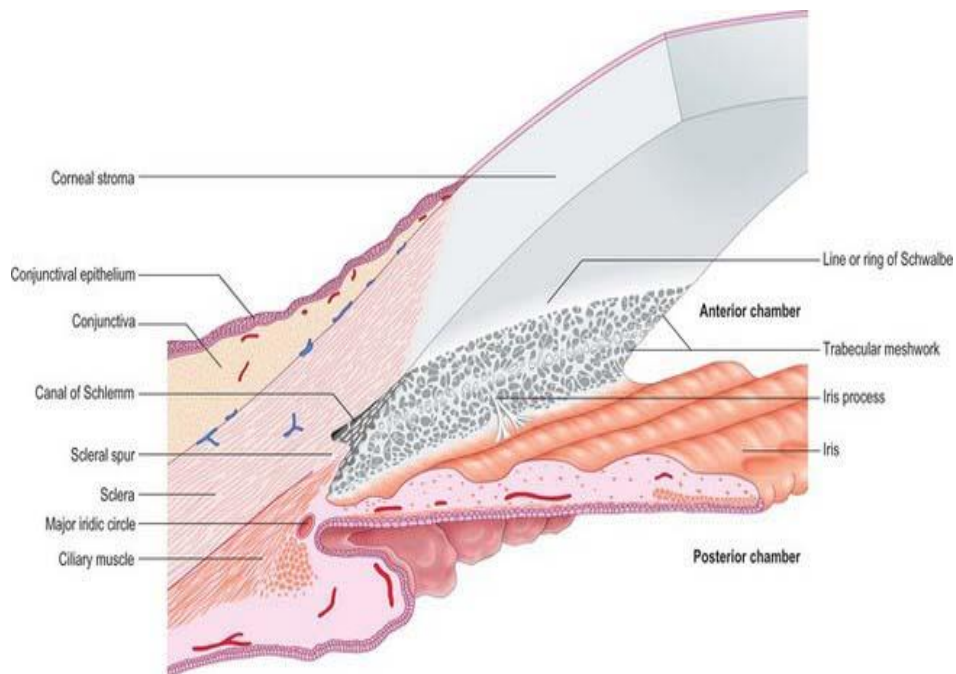
With tremendous increase in medical facilities still there is a large rural population lacking access to modern medicine due to illiteracy, poverty, lack of awareness and therefore lens induced glaucomas are on the rise. Hence eye screening camps play a vital role in prompt identification of cataract cases before complications develop.

In this study we have analyzed the various lens induced glaucomas, its visual outcome and intraocular pressure reduction following surgery.

## ANATOMY

### ANGLE OF THE ANTERIOR CHAMBER:

Aqueous drainage occurs in the angle of anterior chamber.



**FIG1: DIAGRAM SHOWING THE ANGLE STRUCTURES**

Structures present in the angle are: (FIG 1)

1. Ciliary band
2. Scleral spur
3. Trabecular mesh work
4. Schwalbe 's line

**CILIARY BAND:**

- Formed by anterior part of the ciliary body between its attachment with scleral spur and iris.
- Wider in myopes, width depends on level of insertion.
- Appears as a grey or brown band.

**SCLERAL SPUR:**

- Posterior most portion of scleral sulcus.
- In gonioscopy seen as a prominent white line.
- It is made of collagen type 1 and 3.
- On its anterior part corneoscleral trabecular meshwork is attached and posteriorly its attached to ciliary body

**TRABECULAR MESHWORK:**

- Seen anterior to scleral spur.
- Pigmentation in trabecular meshwork increases with age.
- It is a sieve like structure and it bridges the scleral sulcus and converts it into a tube which accommodates the schlemm's canal.

- Fibronectin levels in trabecular meshwork increases with age and in glaucoma cases.
- Changes in glycosaminoglycans and glycoprotein levels are seen with advancing age and in primary open angle glaucoma patients.

It has three parts:

1. Uveal meshwork
2. Corneoscleral meshwork
3. Juxtacanalicular / endothelial trabecular meshwork

- Juxtacanalicular / endothelial trabecular meshwork offers maximum resistance to aqueous outflow.
- The posterior pigmented portion of the trabecular meshwork is the active filtering part.

#### **SCHWALBE'S LINE:**

- Formed by the prominent end of descemet's membrane of cornea.
- Seen as a fine ridge in front of trabecular meshwork
- In gonioscopy a corneal wedge is made to view its position. <sup>(14)</sup>
- Pigmented schwalbe's line seen in pseudo exfoliation and pigmentary glaucoma cases.

## **BLOOD AQUEOUS BARRIER**

It is formed by the tight junctions

- Between the endothelial cells of the iris capillaries
- Between the non-pigmented cells of the ciliary epithelium.
- ★ It excludes large molecules from the aqueous and normally limits the protein of the aqueous humor to less than 1% of its plasma concentration. The normal protein concentration of aqueous humor is 13.5 mg/100ml.
- ★ The breakdown of the barrier, due to various noxious stimuli like prostaglandins in trauma leads to an increase in aqueous protein concentration. In uveitis, when there is extensive breakdown of the barrier, the aqueous humor protein level can be greater than 1 g/100 ml almost similar to that in plasma.
- ★ In addition to the protein quantification, the breakdown of blood aqueous barrier can be evidenced clinically by the presence of flare and increased dye leakage in this fluorescein angiography.

## **AQUEOUS HUMOR DYNAMICS**

Aqueous humor dynamics includes

- Aqueous formation
- Aqueous outflow

### **AQUEOUS FORMATION:**

Aqueous is formed from the ciliary process, mainly from the non pigmented epithelium of ciliary process. Rate of formation is 2-2.5 microlit/min.

Aqueous humor formation is mainly by

1. Diffusion
2. Ultrafiltration
3. Active secretion

Only 10% formation occurs by diffusion. And by ultrafiltration 20% of formation occurs. 70% of aqueous formation is by active secretion. Transport occurs against concentration gradient and energy is consumed by active secretion. <sup>(14)</sup>

### **STEPS OF AQUEOUS FORMATION:**

- ✓ Formation of stromal pool
- ✓ Active transport of stromal filtrates
- ✓ Passive transport across the non-pigmented ciliary epithelium

**FACTORS AFFECTING AQUEOUS HUMOR FORMATION:**

- Age
- Diurnal variation
- Physical activity
- Hypothermia
- Trauma
- Inflammation in eyes
- Hypotension
- Carotid occlusive disease
- Drugs : anesthetic agents, systemic anti hypertensive drugs
- Sleep

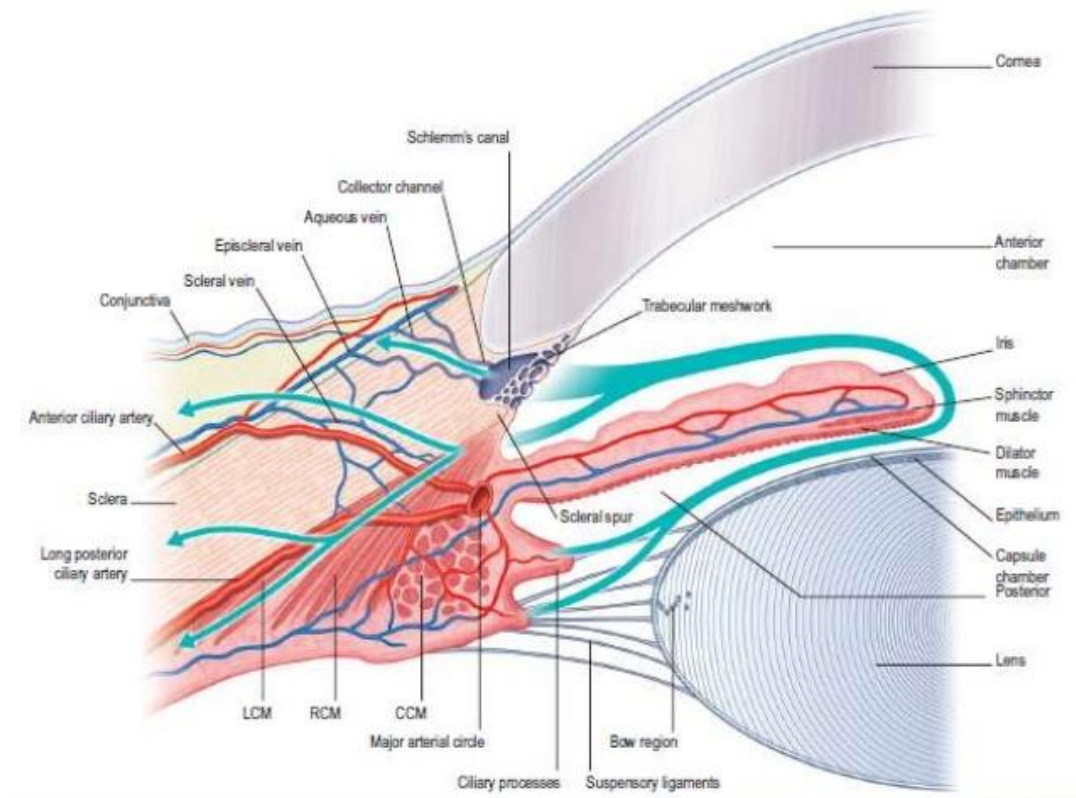
**AQUEOUS OUTFLOW:**

Aqueous flows from the posterior chamber to anterior chamber through the pupil against slight resistance.

In the anterior chamber convection current occurs because the anterior part of chamber is cooler due to tear film and avascularity of cornea and posterior part is warmer due to warm iris.



Hence aqueous moves upwards along the warmer iris and flows downwards in cooler cornea.



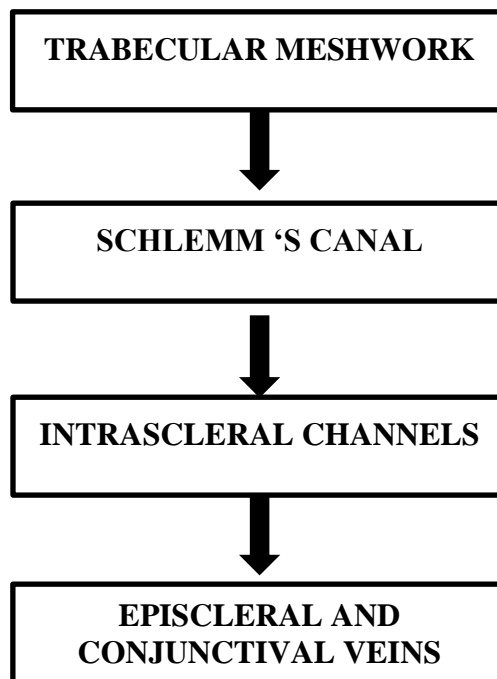
**FIG 2: DIAGRAM SHOWING AQUEOUS OUTFLOW PATHWAYS**

**TYPES OF OUTFLOW MECHANISM:**

- a) Trabecular outflow( conventional pathway) ( FIG 2)
- b) Uveoscleral outflow( unconventional pathway)

**TRABECULAR OUTFLOW (CONVENTIONAL PATHWAY):**

- 75-90% of outflow occurs via this pathway.



**UVEOSCLERAL OUTFLOW (UNCONVENTIONAL PATHWAY):**

- 10-25% of outflow occurs by this pathway
- Aqueous flows from the site of production to suprachoroidal space and drains via the venous circulation.
- It's independent of intraocular pressure.
- This flow occurs because suprachoroidal pressure is 2-4 mmhg less than the anterior chamber pressure. <sup>(14)</sup>
- MMP-1(matrix metallo proteinase-1) plays a role in uveoscleral outflow.
- A prostaglandin analogue increases the uveoscleral outflow.
- Factors decreasing uveoscleral outflow are miotics, increasing age.

## EXAMINATION OF A GLAUCOMA CASE

### GLAUCOMA:

Glaucoma is a chronic progressive optic neuropathy which is characterized by optic nerve head changes and raised intraocular pressure and visual field defects.

Intraocular pressure is the only modifiable risk factor.

Glaucoma can be broadly classified as

- Congenital
- primary open angle/ angle closure glaucoma
- secondary open angle/ angle closure glaucoma

For all glaucoma cases following examination must be done to arrive at a diagnosis

- ✓ Visual acuity
- ✓ Intraocular pressure measurement
- ✓ Gonioscopy
- ✓ Examination of optic nerve head
- ✓ Visual field examination

## **INTRAOCULAR PRESSURE MEASUREMENT**

- ★ Intraocular pressure measurement is an important step in all glaucoma cases.
- ★ Various methods for intraocular pressure measurements are used.
- ★ Intraocular pressure has a diurnal variation and hence the time of recording is an important factor.
- ★ Intraocular pressure measurement at each follow up visit is mandatory to decide on the titration of treatment.

### **TYPES OF TONOMETERS:**

- Schiotz tonometer
- Goldmann applanation tonometer( Gold standard)
- Non contact tonometer
- Rebound tonometer
- Mackay marg tonometer
- Maklakov tonometer
- Dynamic contour tonometer
- Ocular response analyser
- Pressure phosphene tonometer
- Tono pen

## **GOLDMANN APPLANATION TONOMETER:**

- It is a Gold Standard method.
- Measures IOP by providing force which flattens the cornea.
- Principle: IMBERT FICKS LAW

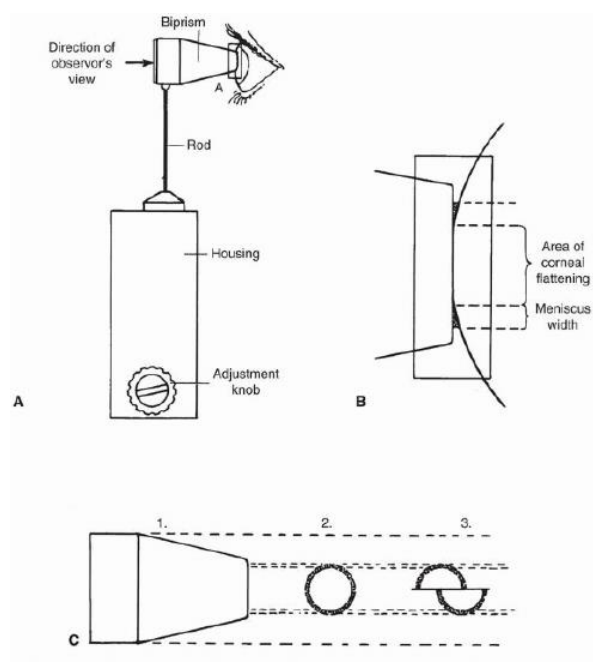
$$P = F/A$$

P-pressure within a sphere

F-force needed to flatten a portion of the sphere

A-area of the sphere which is flattened

- It is a constant area applanating type of tonometer, it applanates a corneal diameter of 3.06mm.( FIG 3)



**FIG3: APPLANATION TONOMETER**

### **NON CONTACT TONOMETER:**

- It was first introduced by Grolman.
- A constant force is used to applanate the cornea.
- This force is directly proportional to the IOP.
- The time taken from an internal reference point to the moment of flattening is measured and its converted to IOP values<sup>(13)</sup>
- A jet of air is used to flatten the cornea.
- When the reflected light is at peak intensity then the cornea is presumed to be flattened.(FIG 4)
- It is useful in measuring IOP in post-operative patients.
- Since it's a non-contact method, less chances of infection.
- IOP Values are comparable with Goldmann applanation values.



**FIG4: NON CONTACT TONOMETER**

### **REBOUND TONOMETER:**

- Light, disposable, sterile probe is propelled forward into cornea by a solenoid.( FIG 5)
- Time taken for the probe to return to its resting position and characteristics of rebound motion are indicative of IOP.
- No need for topical anesthesia
- Can be used in post operative patients
- Portable and easy to handle device.
- Risk of infection is less.



**FIG5: REBOUND TONOMETER**

**GONIOSCOPY:**

- ✓ Gonioscopy is done to study the angle structures.
- ✓ Normally angle of anterior chamber is not visualized due to total internal reflection of light rays.
- ✓ This is overcome by using a gonio lens to study the angle.
- ✓ It overcomes the total internal reflection and exceed the critical angle ( $46^{\circ}$ ) by altering the cornea air fluid interface by a tear film gonio lens interface<sup>(1)</sup>

**TYPES OF GONIOLENSES:****DIRECT:**

- Koeppe
- Barkan
- Swan Jacob

**INDIRECT:**

- Goldmann single mirror
- Goldmann three mirror
- Zeiss four mirror
- Posner
- Sussman four mirror
- Ritch lens

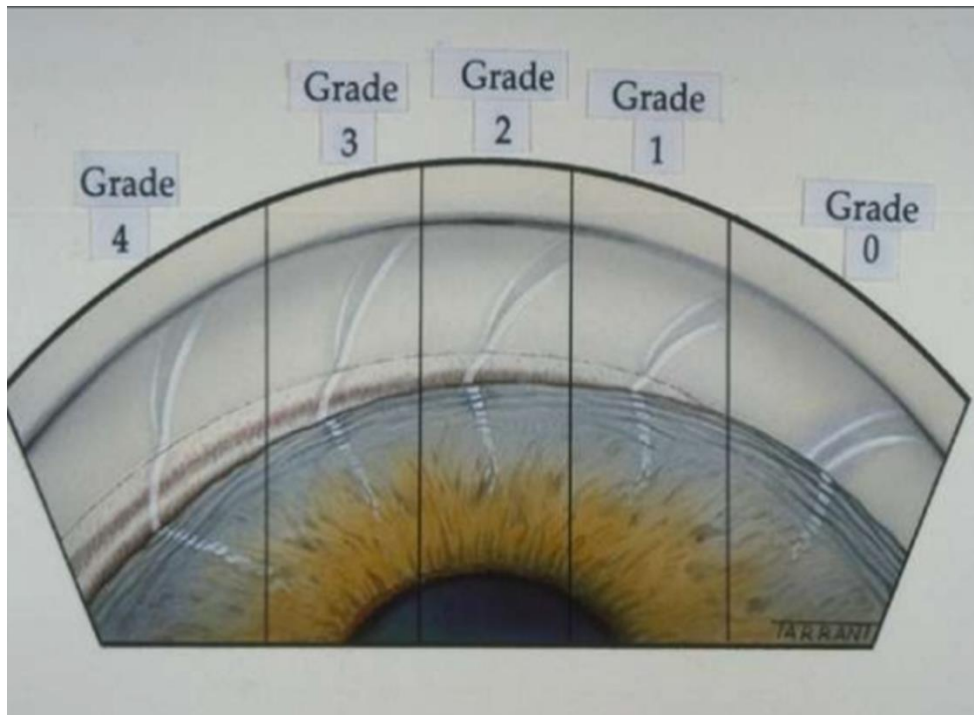


**ADVANTAGES OF DIRECT AND INDIRECT LENSES:**

	<b>DIRECT</b>	<b>INDIRECT</b>
1	PANAROMIC VIEW OF ANGLE STRUCTURES CAN BE SEEN	EQUIPMENT AND EXAMINATION PROCEDURES ARE FAMILIAR
2	GOOD PATIENT COMFORT	CAN BE DONE QUICKLY
3	CAN BE USED FOR SURGERY	INDENDATION GONIOSCOPY CAN BE DONE

**SHAFFER SYSTEM OF ANGLE GRADING: (FIG 6)**

- Grade 0 : closed angle
- Grade S : slit like angle,  $<10^{\circ}$
- Grade 1 : extremely narrow,  $10^{\circ}$ (up to schwalbe's line)
- Grade 2 : moderately narrow,  $20^{\circ}$ , (up to functional trab)
- Grade 3 :  $30^{\circ}$ , non occludable (up to scleral spur seen)
- Grade 4 :  $35^{\circ}$ - $45^{\circ}$  non occludable ( up to ciliary body band seen)<sup>(2)</sup>



**FIG 6: PICTURE SHOWING SCHAFFER GRADING OF ANGLE**

**VAN HERICK METHOD OF ANTERIOR CHAMBER ANGLE**

**MEASUREMENT:**

<b>GRADE</b>	<b>AC DEPTH AS A PROPORTION OF CORNEAL THICKNESS</b>	<b>DESCRIPTION</b>
4	$\geq 1$	AC depth = peripheral corneal thickness
3	$1/4 - 1/2$	AC depth $1/4 - 1/2$ of peripheral corneal thickness
2	$1/4$	AC depth $1/4$ of peripheral corneal thickness
1	$< 1/4$	AC depth $< 1/4$ of peripheral corneal thickness

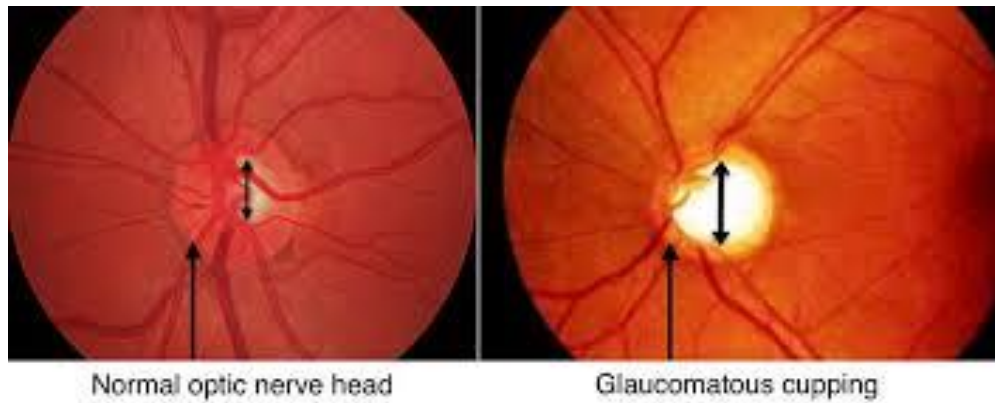
## **FUNDUS EXAMINATION:**

In glaucoma cases examination of optic nerve head is very important.

## **OPTIC NERVE HEAD EVALUATION:**

In an optic nerve head the following features has to be examined:

- Disc size, shape, margins, and colour.
- Cup size, shape.
- Cup disc ratio( increased/ asymmetry  $>0.2$  difference between both eyes) (FIG 7)
- Neuroretinal rim (colour / focal notch/thinning/ concentric loss)
- Retinal nerve fiber layer( wedge /slit defects/ diffuse)
- Vessel changes like nasalization, bayonetting, barring of circum linear vessels <sup>(1)</sup>
- Disc hemorrhages
- Parapapillary area atrophy
- Laminar dot sign



**FIG7: PICTURE SHOWING NORMAL AND GLAUCOMATOUS ONH**

- In diabetic and hypertensive patients should be screened for retinopathy changes.
- Macular changes should be assessed before any surgery as it affects the visual outcome after surgery.
- Documentation of disc findings at each visit is must to assess the progression of glaucoma.
- The optic nerve head changes and retinal nerve fiber layer changes will be corresponding to the field defects.

#### **EXAMINATION OF VISUAL FIELDS:**

Visual field examination can be done using

- Kinetic perimetry
- Static perimetry

### KINETIC PERIMETRY:

- Bjerrum target screen is used for kinetic perimetry.
- The target is moved from non-seeing area to until patient sees the target.
- Targets of different luminance can be used.
- The brightest target will have largest isopter. <sup>(13)</sup>

### STATIC PERIMETRY:

- Automated perimetry is a type of static perimetry.
- The intensity and size of stimuli can be changed.
- More reliable and accurate method.
- Reproducible method of visual field analysis.
- Visual field progression can be analysed over a period of time.
- Threshold detection is more sensitive
- The standardized technology reduces the need for highly trained technicians.

**VISUAL FIELD DEFECTS IN GLAUCOMA:**

- Para central scotoma
- Nasal step
- Seidel scotoma
- Arcuate scotoma
- Double arcuate scotoma<sup>(1)</sup>
- ✳ Visual field defects in glaucoma respect horizontal meridian.
- ✳ In end stage only a temporal island of vision remains.

**TYPES OF AUTOMATED PERIMETRY:**

- HUMPHREY
- OCTOPUS

**OTHER ADVANCED TYPES:**

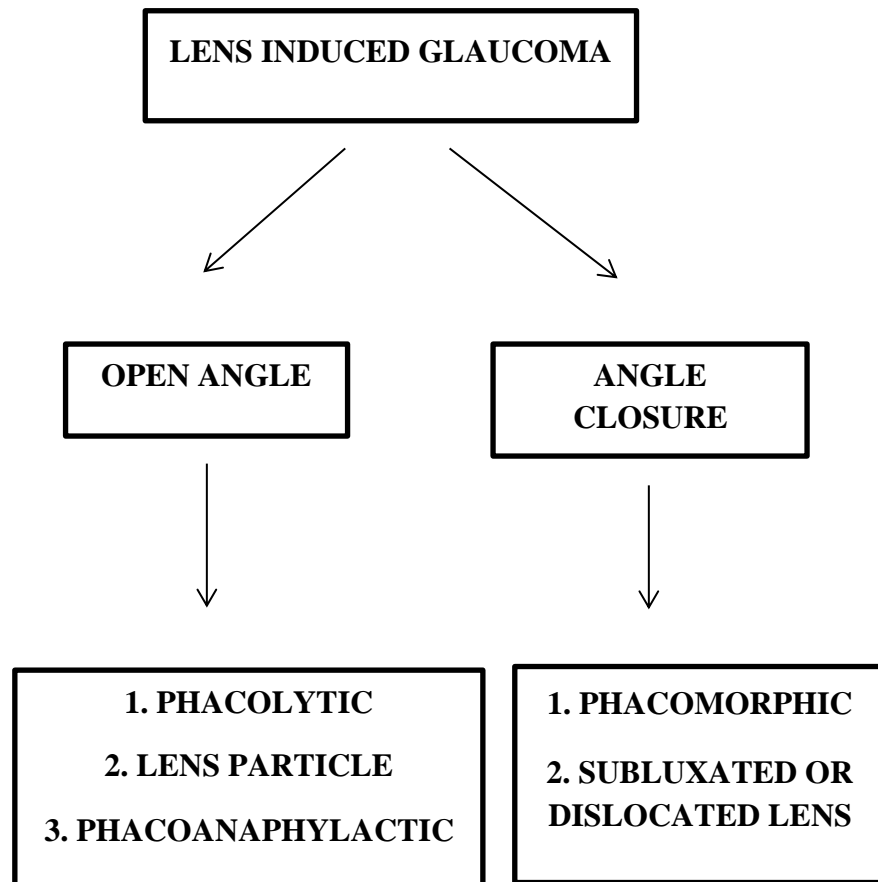
- SWAP(SHORT WAVE AUTOMATED PERIMETRY)
- FREQUENCY DOUBLING TECHNOLOGY
- FLICKER PERIMETRY
- MOTION DETECTION PERIMETRY
- MICROPERIMETRY

## LENS INDUCED GLAUCOMAS

- Lens induced glaucoma is a type of secondary glaucoma.
- It can be an open angle or angle closure type.
- It occurs either due to ageing changes, trauma or congenital dislocation/subluxation of lens.
- Due to lack of knowledge, illiteracy, transportation, lens induced glaucoma cases are on rise in rural population.
- Patients ignore the visual loss and present only when they develop symptoms.

It is of the following types:

- a. Phacolytic glaucoma
- b. Phacomorphic glaucoma
- c. Lens particle glaucoma
- d. Phacoanaphylactic glaucoma
- e. Subluxated/ dislocated lens induced glaucoma



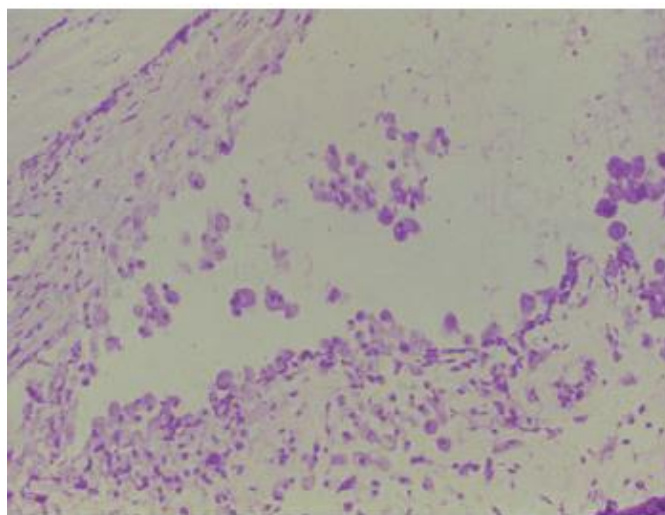
### PHACOLYTIC GLAUCOMA:

- *Gifford* first described the phacolytic glaucoma and its clinical presentations.
- *Zeeman* and *Irvin* postulated theories for the development of phacolytic glaucoma.
- *Flocks* was the first one to use the term “phacolytic glaucoma” in 1955.



**PATHOPHYSIOLOGY:**

- Phacolytic glaucoma mostly occurs in mature or hyper mature cataract cases.
- Through the micro pores in anterior lens capsule, lens proteins leak into anterior chamber and these are phagocytosed by macrophages.
- Trabecular outflow obstruction occurs due to macrophages and high molecular weight lens proteins.
- Pathological studies had confirmed this trabecular outflow obstruction by demonstrating eosinophilic, protein like material in trabecular meshwork in cadaveric eyes. (FIG 8)
- Due to outflow obstruction of aqueous raised intraocular pressure occurs. <sup>(5)</sup>



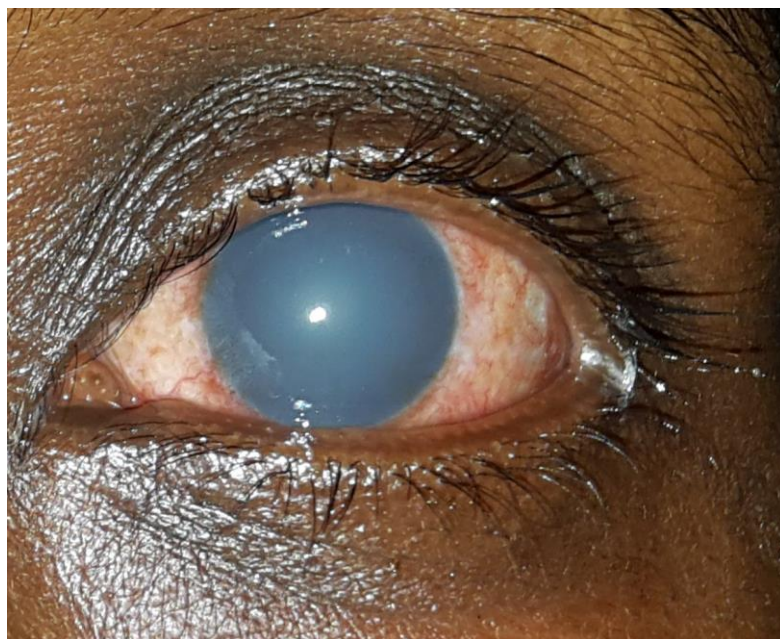
**FIG 8: HISTOLOGY SHOWING MACROPHAGES IN ANGLE**

**CLINICAL FEATURES:****SYMPTOMS:**

- ✓ decreased vision
- ✓ pain and redness

**SIGNS:**

- ✓ circumcorneal congestion
- ✓ corneal edema
- ✓ dense cells and flare in anterior chamber
- ✓ **normal anterior chamber depth**
- ✓ mature / hyper mature cataract with intact anterior capsule( FIG 9)
- ✓ Gonioscopy: open angles are seen.

**FIG 9: PHACOLYTIC GLAUCOMA**

**PHACOMORPHIC GLAUCOMA:**

- Phacomorphic glaucoma occurs due to forward displacement of iris due to enlarged cataractous lens.

**PATHOPHYSIOLOGY:**

- Phacomorphic glaucoma occurs due to anterior mechanical force of lens on to the iris.
- Lens enlargement occurs due to various factors like age, diabetes, diuretics <sup>(5)</sup>
- Other factors which cause anterior displacement of lens are trauma, zonular weakness due to pseudo exfoliation.
- The peripheral irido lenticular contact increases.
- Due to inflammation and iridotrabecular contact, peripheral anterior synechiae formation occurs.
- Mostly within 72 hours of onset of symptoms peripheral anterior synechiae formation occurs.
- Pupillary block can also occur.

**CLINICAL FEATURES:****SYMPTOMS:**

- ✓ Pain
- ✓ Defective vision
- ✓ Redness
- ✓ Nausea ,vomiting
- ✓ Headache

**SIGNS: (FIG 10)**

- ✓ Circum corneal congestion
- ✓ Corneal edema
- ✓ Shallow anterior chamber both central and peripheral
- ✓ Pupil mid dilated, not reacting to light
- ✓ Mature cataract
- ✓ In gonioscopy – angles will be closed and peripheral anterior synechiae can be seen.



**FIG 10: PHACOMORPHIC GLAUCOMA**

### **LENS PARTICLE GLAUCOMA:**

Lens particle glaucoma is a type of open angle glaucoma due to outflow obstruction.

### **PATHOPHYSIOLOGY:**

- Free lens material, cortical matter, macrophages with degenerated lens material obstructs the trabecular meshwork. <sup>(5)</sup>
- Due to this aqueous outflow obstruction occurs and intraocular pressure elevates.
- Liberation of lens particle can occur due to

- ✓ spontaneous rupture of anterior lens capsule in mature cataract cases
- ✓ Trauma
- ✓ Retained cortical matter after cataract extraction surgery.

### **CLINICAL FEATURES:**

### **SYMPTOMS:**

- ✓ Pain and redness
- ✓ Defective vision

### **SIGNS: (FIG 11)**

- ✓ Circum corneal congestion
- ✓ Corneal edema
- ✓ **White lens particles in anterior chamber**
- ✓ Lens debris sticking to endothelium
- ✓ Hyper mature/ mature cataract with anterior capsule rupture.



**FIG 11: LENS PARTICLE GLAUCOMA**

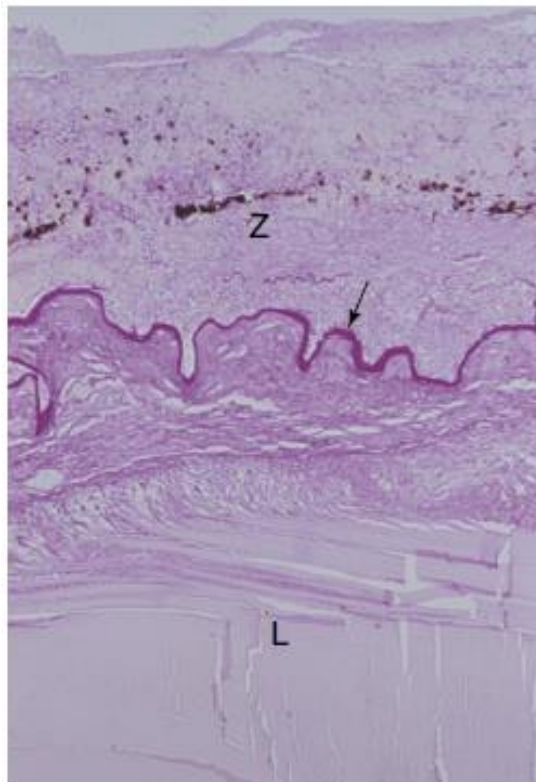
**PHACOANAPHYLACTIC GLAUCOMA:**

- *Verhoeff* and *Lemoine* first reported cases of hypersensitive reaction to lens protein and termed it as, endophthalmitis phacoanaphylactica.
- *Risse* reported the clearing of uveitis after removal of posterior capsule.

**PATHOPHYSIOLOGY:**

- Lens particles induce a granulomatous inflammatory reaction.
- Some authors suggest it is due to an immune mediated reaction.

- The term phacoanaphylaxis is a misnomer as it does not cause any Ig E mediated reaction.
- It causes mostly open angle glaucoma due to blockage of trabecular meshwork with inflammatory products or trabecular meshwork inflammation.( FIG 12)
- Sometimes angle closure also can occur due to peripheral anterior synechiae formation.



**FIG 12: PAS STAINED SPECIMEN SHOWING L-LENS  
MATERIAL AND Z-ZONAL INFLAMMATION**



**CLINICAL FEATURES:****SYMPTOMS:**

- ✓ Decreased vision
- ✓ Pain and redness

**SIGNS:**

- ✓ Circum corneal congestion
- ✓ Keratic precipitates
- ✓ Anterior chamber cells and flare
- ✓ Hypopyon

**SUBLUXATED/DISLOCATED LENS INDUCED GLAUCOMA:**

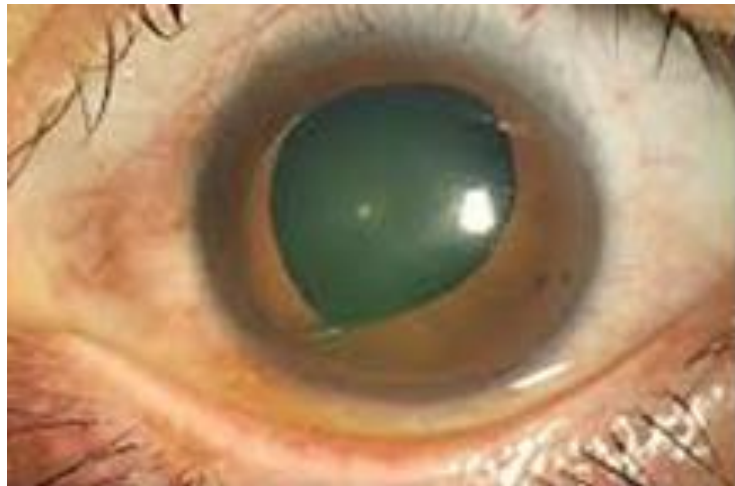
- *Stellwag* first coined the term “Ectopia Lentis” in 1856.
- *Berryat* reported a case of bilateral anterior lens subluxation way back in 1749.
- *Sichel* described the difference between traumatic and spontaneous dislocation of lens.
- *Arlt* described the congenital factors for dislocation of lens.

**PATHOPHYSIOLOGY:**

- \* Due to abnormality in lens zonules, subluxation/ dislocation of lens occurs.
- \* Most common cause for dislocation/subluxation of lens is trauma.
- \* Zonular weakness is also seen in cases of pseudo exfoliation, high myopia, uveitis, buphthalmos, intraocular tumors
- \* In Congenital syndromes like Marfan's, homocystinuria, Weill marchesani syndrome, Ehler –Danlos syndrome ,ectopia lentis occurs. <sup>(5)</sup>
- \* Due to altered lens position pupillary block occurs and raises intraocular pressure.
- \* Peripheral anterior synechiae may form in cases which are long standing. (FIG 13 A&B)

**CLINICAL FEATURES:**

- ✓ Subluxated / dislocated lens
- ✓ Iridodonesis
- ✓ Phacodonesis
- ✓ Abnormal zonules
- ✓ Vitreous in pupillary area
- ✓ Gonioscopy shows narrow angles.



**FIG 13 A: PICTURE SHOWING SUBLUXATED LENS**

**FIG13 B:PICTURE SHOWING DISLOCATED LENS**

### **MANAGEMENT**

- ❖ In lens induced glaucomas the main stay of treatment is removal of lens to reduce the intraocular pressure.
  
- ❖ Before lens removal intraocular inflammation and intraocular pressure should be reduced.

**PRE-OPERATIVE TREATMENT:**

- ✓ All cases should be started on anti-glaucoma medications to reduce IOP before surgery.
- ✓ If IOP > 30 mmHg is recorded, patients are started on Inj. 20% Mannitol 200ml IV BD for IOP reduction.
- ✓ Patients are started on topical beta blockers (0.5% Timolol eye drops BD) if no systemic contraindications are present.
- ✓ If IOP is still high, then oral carbonic anhydrase inhibitors are added. (Tab. Acetazolamide 250mg QID)
- ✓ To reduce inflammation topical steroids are used. (prednisolone acetate eye drops 6 times a day)
- ✓ In cases of phacolytic, lens particle, phaco anaphylactic glaucomas, cycloplegic drugs are used to reduce inflammation and relieve ciliary spasm (homatropine eye drops BD or cyclopentolate eye drops TDS).

**SURGICAL MANAGEMENT:**

- In lens induced glaucomas lens removal is the main stay of treatment.
- Small incision cataract surgery is mostly done and a posterior chamber IOL is implanted.

- Extra capsular cataract extraction can also be done with a posterior chamber IOL implantation.
- If peripheral anterior synechiae is present then a combined procedure is required. It includes cataract surgery and trabeculectomy.
- In phacomorphic glaucoma if symptoms are present more than 72 hours a combined procedure is done. Because due to iridotrabecular contact and inflammation there is more predilection for formation of peripheral anterior synechiae in these cases.
- In phacomorphic glaucoma, if symptoms are present less than 72 hours or if PAS is not seen in gonioscopy then a Small incision cataract surgery (SICS) with peripheral iridectomy (PI) is done.
- If a posterior chamber IOL could not be implanted due to a posterior capsule rent or vitreous loss then a secondary IOL implantation is done in second sitting.
- Secondary IOL implantation can be an Iris claw lens or a scleral fixation lens.
- Secondary IOL implantation is preferred mostly after inflammation resolves.

**POST-OPERATIVE TREATMENT:**

- ✓ All post-operative cases are started on topical antibiotics and steroids to reduce inflammation.
- ✓ 0.5 %Moxifloxacin eye drops 6 times daily with 1%prednisolone acetate eye drops 6 times daily is used.
- ✓ In cases of severe post operative iritis subconjunctival dexamethasone injection of 0.5cc is given in addition to routine drugs.
- ✓ In post-operative iritis cycloplegics are used (cyclopentolate eye drops TDS).
- ✓ In cases of striate keratopathy , 5 %hypertonic sodium chloride eye drops is used four times daily.
- ✓ Oral antibiotic drug (Tab.ciprofloxacin 500 mg BD) is given for 5 days.
- ✓ Oral anti-inflammatory drugs are also given to reduce the pain.
- ✓ Patients are advised to wear dark goggles post operatively to prevent any trivial trauma to eye.

- ✓ Lid hygiene should be maintained post operatively.
- ✓ Drug instillation is demonstrated to the patients and is advised to use drops at prescribed intervals.
- ✓ Patients and care takers are advised to wash their hands before instillation of drops.
- ✓ Patients should avoid violent coughing, straining, and lifting heavy weights during post-operative period.
- ✓ Patients are advised to come for follow up as per the advice of the surgeon.

#### **POST OPERATIVE FOLLOW UP:**

- ✓ During each follow up patients best corrected visual acuity is checked.
- ✓ Intraocular pressure measurements were done using non-contact or rebound tonometer.
- ✓ Applanation tonometer is avoided in early post-operative period to avoid infections to operated eye.
- ✓ Slit lamp biomicroscopy examination is done to look for any signs of inflammation, status of cornea, position of intraocular lens, wound site, bleb and status of sutures.

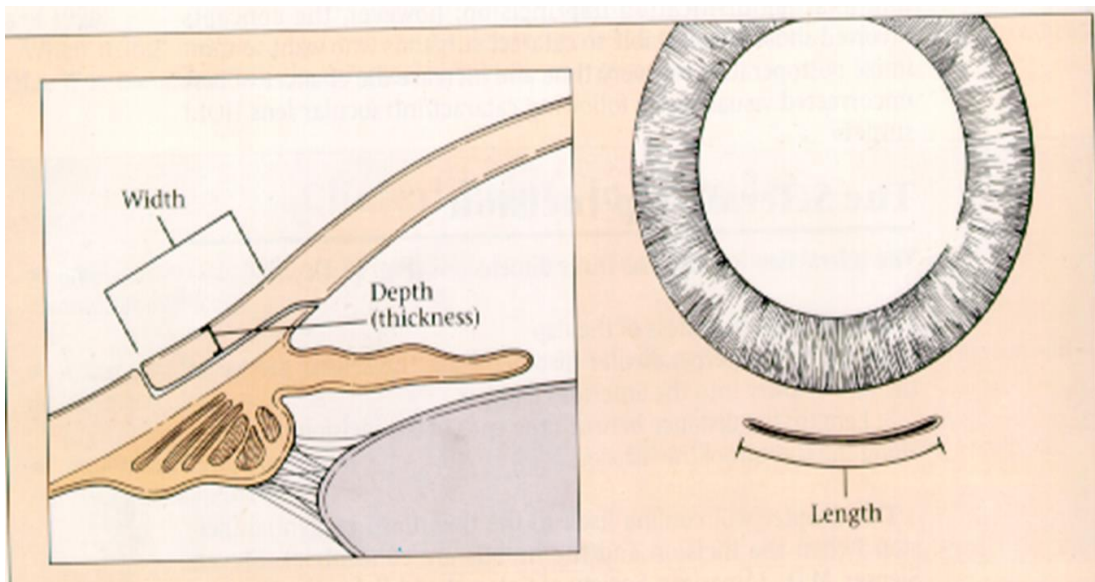
- ✓ After 6 weeks period gonioscopy is done to analyse the angle status.
- ✓ Visual field examination is done after 6 weeks either by manual method or by automated perimetry.

### **STEPS OF SMALL INCISION CATARACT SURGERY**

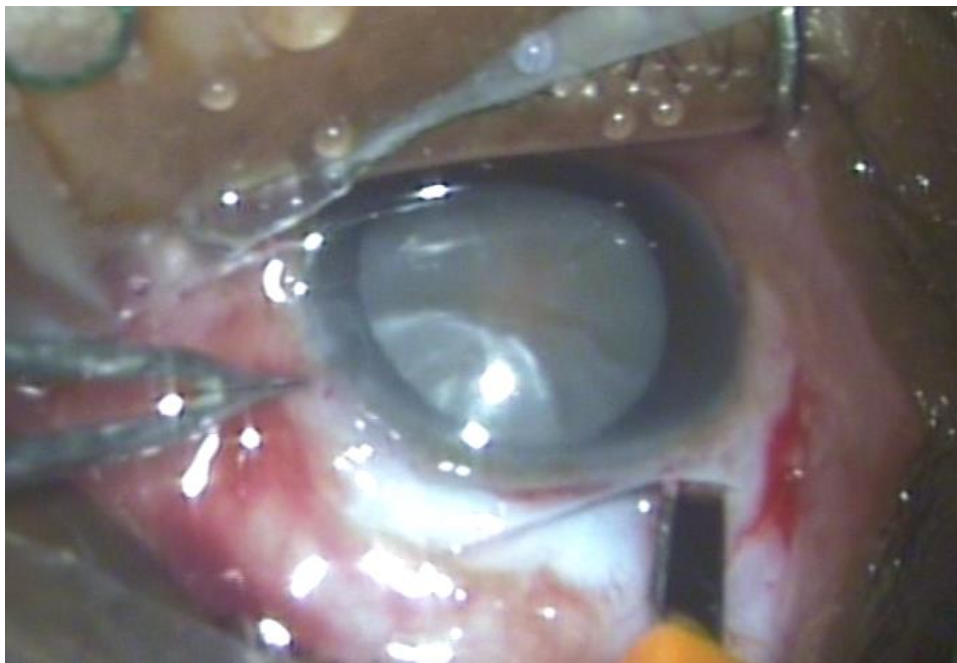
- Local anaesthesia was given using 2% xylocaine mixed with hyaluronidase and adrenaline. Peribulbar block was given.
- Eye was painted with betadine solution and sterile drape was used.
- Universal eye speculum was applied.
- Superior rectus suture was secured and clamped.
- Conjunctival peritomy done and tenon was separated completely and sclera was exposed.
- Hemostasis was achieved using wet field cautery.
- A sclero corneal tunnel incision made. And a side port entry is made and anterior capsule stained with trypan blue.(FIG 14&15)
- Anterior capsulotomy was done by continuous curvilinear capsulorrhexis or can opener technique as per surgeon's preference.



- Hydrodissection was done but avoided in cases of mature/hypermature cataract.
- Nucleus delivered and cortical matter removed by irrigation and aspiration.
- In case of posterior capsular tear, integrity of capsular bag was assessed to place IOL in sulcus.
- In case of vitreous loss, manual anterior vitrectomy was done. And anterior chamber was cleared of vitreous.
- If there was no complication posterior chamber intraocular lens was placed in capsular bag and dialed to place it in position.
- Visco elastic substance was aspirated from anterior chamber.
- Subconjunctival dexamethasone 0.5cc given at end of procedure.
- Topical antibiotic drops was applied.
- Sterile Pad and bandage applied.



**FIG14: FIGURE SHOWING SCLEROCORNEAL TUNNEL IN SICS**



**FIG 15: PICTURE SHOWING SCLERAL TUNNEL CONSTRUCTION IN SICS**

## **STEPS OF EXTRACAPSULAR CATARACT**

### **EXTRACTION:**

- Local anaesthesia was given using 2% xylocaine mixed with hyaluronidase and adrenaline. Peribulbar block was given.
- Eye was painted with betadine solution and sterile drape is used.
- Universal eye speculum was applied.
- Superior rectus suture was secured and clamped.
- Conjunctival peritomy done from 10 o'clock to 2 o'clock and tenon s separated completely and sclera was exposed.
- Hemostasis was achieved using wet field cautery.
- Entry into anterior chamber was made and anterior capsule was stained with trypan blue.
- Anterior capsulotomy was done.
- Corneal entry was extended from 10-2'o clock position and nucleus was delivered by pressure counter pressure technique.
- Cortex wash done and IOL placed in bag.

- Visco elastic substance was aspirated from anterior chamber.
- Anterior chamber was formed after placing sutures with 10-0 nylon.(FIG 16)
- Subconjunctival dexamethasone 0.5cc given at end of procedure.
- Topical antibiotic drops was applied.
- Sterile Pad and bandage applied.



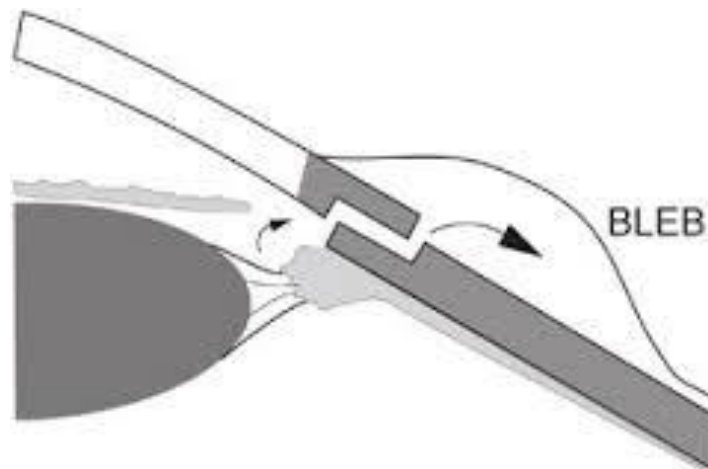
**FIG 16: PICTURE SHOWING ECCE SUTURES**

**STEPS OF COMBINED SURGERY:**

- Local anaesthesia was given using 2% xylocaine mixed with hyaluronidase and adrenaline. Peribulbar block was given.
- Eye was painted with betadine solution and sterile drape is used.

- Universal eye speculum was applied.
- Superior rectus suture was secured and clamped.
- Conjunctival peritomy done to create a fornix based flap and tenon's separated completely and sclera was exposed.
- Hemostasis was achieved using wet field cautery.
- A triangular scleral flap is made at 12 o'CP, which is extended till the limbus. Size and shape of flap is as per surgeon's preference.
- Paracentesis was done and anterior chamber was entered.
- Anterior capsule stained with trypan blue and capsulotomy / capsulorhexis done.
- A 1.5-2.5mm wide block of trabecular tissue was excised under the sclera flap using a Kelly's punch.
- Peripheral iridectomy was done above the site of trabeculectomy ostium to avoid plugging of ostium with iris.
- Scleral tunnel was made and entry was done and extended.
- Nucleus delivered and cortical matter removed by irrigation and aspiration with simcoe cannula.
- IOL placed in bag.

- Scleral flap sutured and water tight closure of conjunctival flap was done using 10-0 nylon.
- Side port was hydrated and formation of bleb was confirmed.( FIG 17 A &B)
- Subconjunctival dexamethasone 0.5cc given at end of procedure.
- Topical antibiotic drops was applied.
- Sterile Pad and bandage applied.



**FIG17 A AND B: PICTURES SHOWING BLEB**

## **AIM AND OBJECTIVES**

### **AIM:**

To clinically analyse visual outcome and intraocular pressure control in lens induced glaucomas following surgery.

### **PRIMARY OBJECTIVES:**

To determine the

- \* Visual outcome
  
- \* Intraocular pressure control following surgery in cases of lens induced glaucomas.

### **SECONDARY OBJECTIVES:**

- \* To study the surgical complications and reasons for reduced visual acuity following manual small incision cataract surgery /ECCE/ combined surgery/lens removal with secondary IOL in cases of lens induced glaucomas.

## **MATERIALS AND METHODS**

### **SUBJECT SELECTION:**

100 patients with LENS INDUCED GLAUCOMA attending glaucoma services of Regional Institute of Ophthalmology and Government Ophthalmic Hospital were included in the study.

### **INCLUSION CRITERIA:**

Patients with phacolytic glaucoma / phacomorphic glaucoma/ phacoanaphylaxis /lens particle glaucoma/ any subluxated or dislocated lens with raised IOP.

### **EXCLUSION CRITERIA:**

- Patients under the age of 18.
- Patients with primary open angle glaucoma and primary angle closure glaucoma.
- Patients with other secondary glaucomas.
- Patients with uncontrolled diabetes, hypertension, ischemic heart disease.



**EXAMINATION METHODS:**

All were subjected to

- Anterior segment examination by slit lamp bio microscopy.
- Best corrected visual acuity by Snellen chart.
- Intraocular pressure measurement either by Goldmann applanation tonometry or in cases with presence of corneal edema rebound tonometry reading was recorded.
- Fundus examination and in cases with no view of fundus

B scan will be done

- Gonioscopic examination with Goldmann single mirror lens.
- In cases of lens subluxation, an Ultrasound Biomicroscopy (UBM) will be done to know the degree of zonular dehiscence.
- Routine investigations like Blood sugar, Urine analysis, blood pressure measurement will be done.
- Keratometry, Axial length, IOL power will be calculated in patients undergoing surgery.

**FOLLOW UP:**

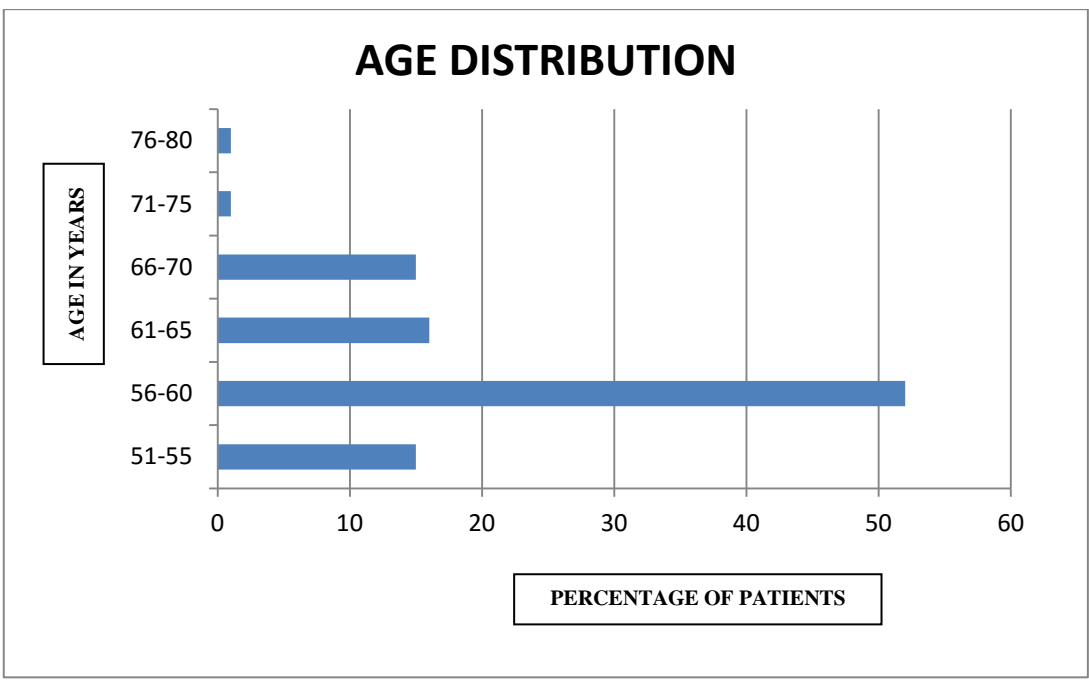
- ✓ Patient undergoing cataract / combined surgery/lens removal with secondary IOL will be under follow up for 6 weeks {post op day 1, 3, 7, and in end of 2nd, 4th and 6th week}.
- ✓ At each visit visual acuity measurement, anterior segment examination by slit lamp, intraocular pressure by non-contact tonometer / rebound tonometer and fundus examination will be done .
- ✓ End of one month gonioscopy is repeated and field examination is done with automated perimetry/ manual fields.

# RESULTS

## 1. AGE DISTRIBUTION:

AGE IN YEARS	NO.OF PATIENTS	PERCENTAGE
51-55	15	15
56-60	52	52
61-65	16	16
66-70	15	15
71-75	1	1
76-80	1	1

**TABLE1: SHOWING AGE DISTRIBUTION OF PATIENTS**



**CHART1: SHOWING AGE DISTRIBUTION OF PATIENTS**

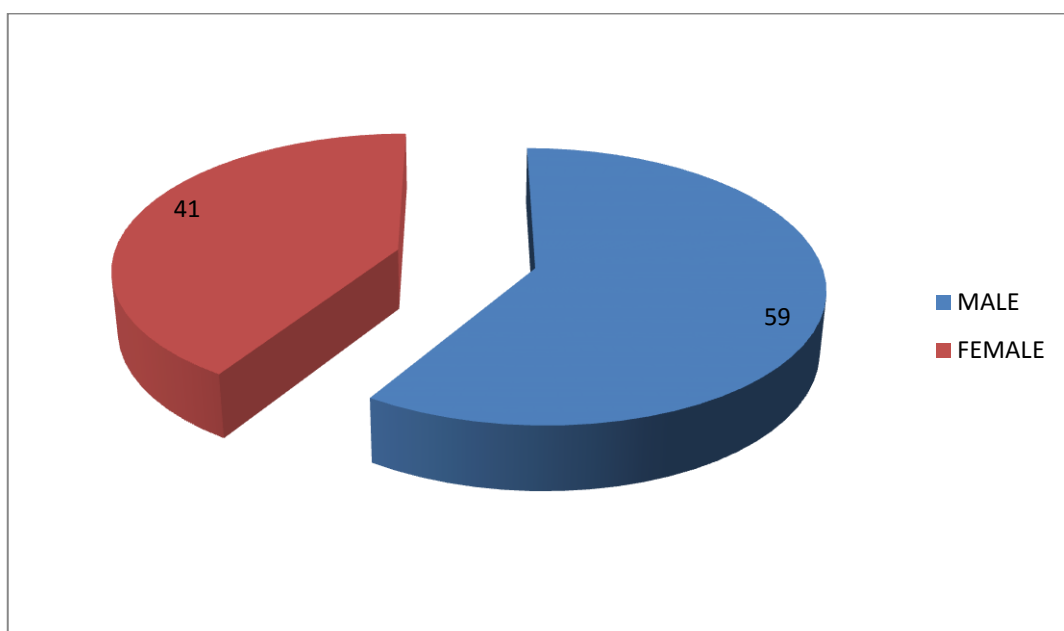
In our study, among the **100** cases, **15** cases presented between age group 51-55years, **52** cases in age group 56-60years, **16** cases in age group 61-65 years, **15** cases in age group 66-70 years, **1** case in age group 71-75, **1** case in age group 76-80years.

Maximum numbers of cases (**52%**) were in the age group of **56 -60** years.

## 2. SEX DISTRIBUTION:

SEX	NO.OF PATIENTS	PERCENTAGE
MALE	59	59
FEMALE	41	41

**TABLE2: TABLE SHOWING THE SEX DISTRIBUTION**



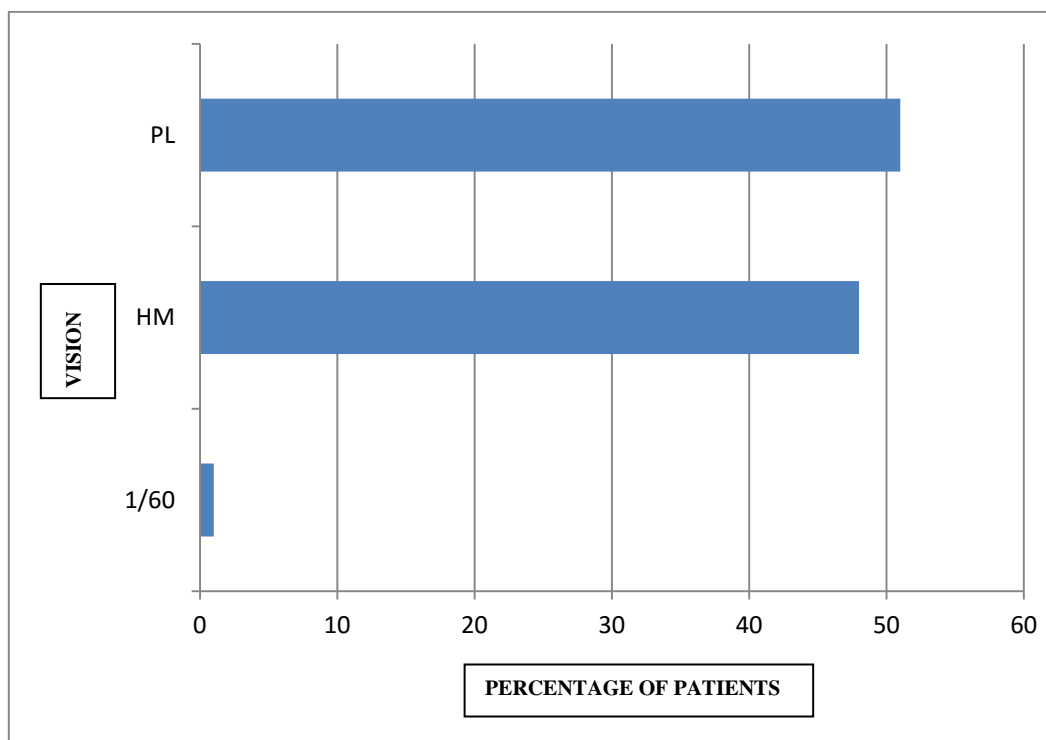
**CHART2: CHART SHOWING THE SEX DISTRIBUTION**

Among the 100 cases in this study, **59%** were males and **41%** were females.

### 3. VISION AT THE TIME OF PRESENTATION:

VISION	NO OF EYES	PERCENTAGE
1/60	1	1
HM	48	48
PL	51	51

**TABLE 3: TABLE SHOWING THE VISION OF THE PATIENTS AT THE TIME OF PRESENTATION**



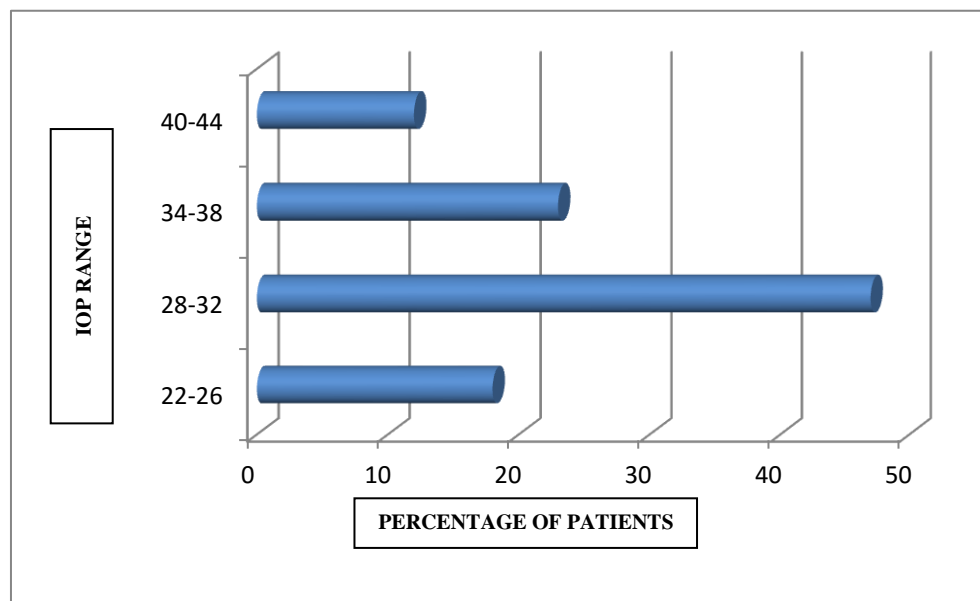
**CHART3: CHART SHOWING THE VISION OF THE PATIENTS AT THE TIME OF PRESENTATION**

In our study out of 100 cases, **51%** patients presented with a vision of perception of light(PL), **48%** patients presented with a vision of hand movements(HM), **1%** patients presented with a vision of reading at 1 meter distance(1/60)

#### 4. IOP AT THE TIME OF PRESENTATION:

<b>IOP RANGE (mmhg)</b>	<b>NO OF EYES</b>	<b>PERCENTAGE</b>
22-26	18	18
28-32	47	47
34-38	23	23
40-44	12	12

**TABLE 4: TABLE SHOWING IOP AT THE TIME OF PRESENTATION**



**CHART 4: CHART SHOWING IOP AT THE TIME OF PRESENTATION**

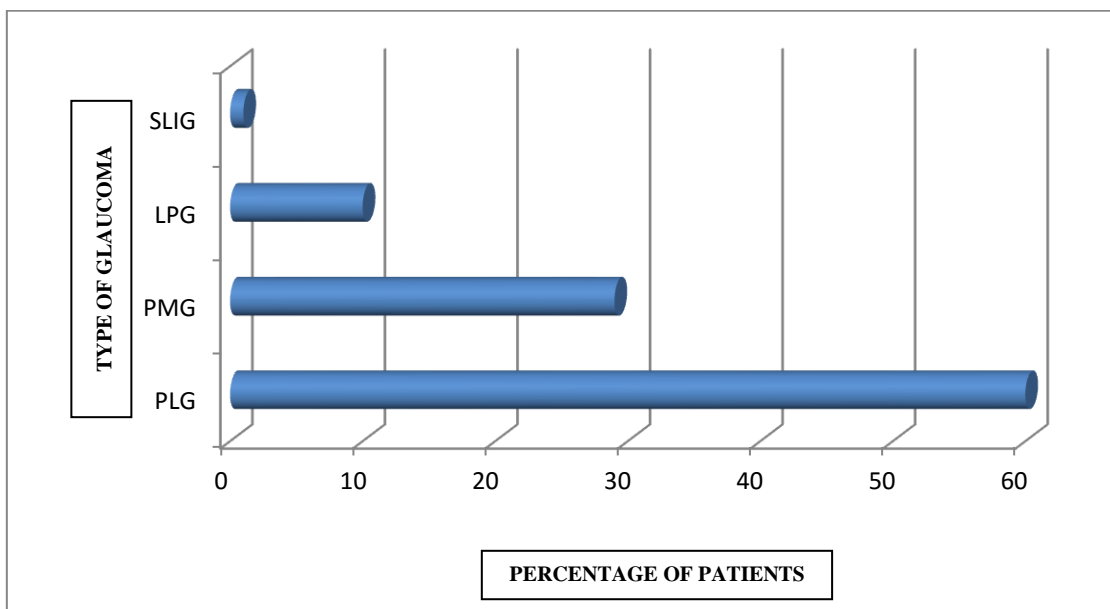
In our study, among 100 cases, **18%** cases presented in an IOP range of 22-26 mmhg, **47%**cases presented in IOP range of 28-32mmhg,**23%** cases presented in IOP range of 34-38mmhg, **12%**cases presented in IOP range 40-44mmhg.

Maximum cases (**47%**) presented with an IOP of **28-32mmhg**.

### **5. PERCENTAGE OF VARIOUS LENS INDUCED GLAUCOMA:**

<b>TYPE OF GLAUCOMA</b>	<b>NO OF EYES</b>	<b>PERCENTAGE</b>
PHACOLYTIC GLAUCOMA (PLG)	60	60
PHACOMORPHIC GLAUCOMA(PMG)	29	29
LENS PARTICLE GLAUCOMA(LPG)	10	10
SUBLUXATED LENS INDUCED GLAUCOMA(SLIG)	01	01

**TABLE 5: TABLE SHOWING % OF VARIOUS LENS INDUCED  
GLAUCOMAS**



**CHART 5: CHART SHOWING % OF VARIOUS LENS INDUCED GLAUCOMAS**

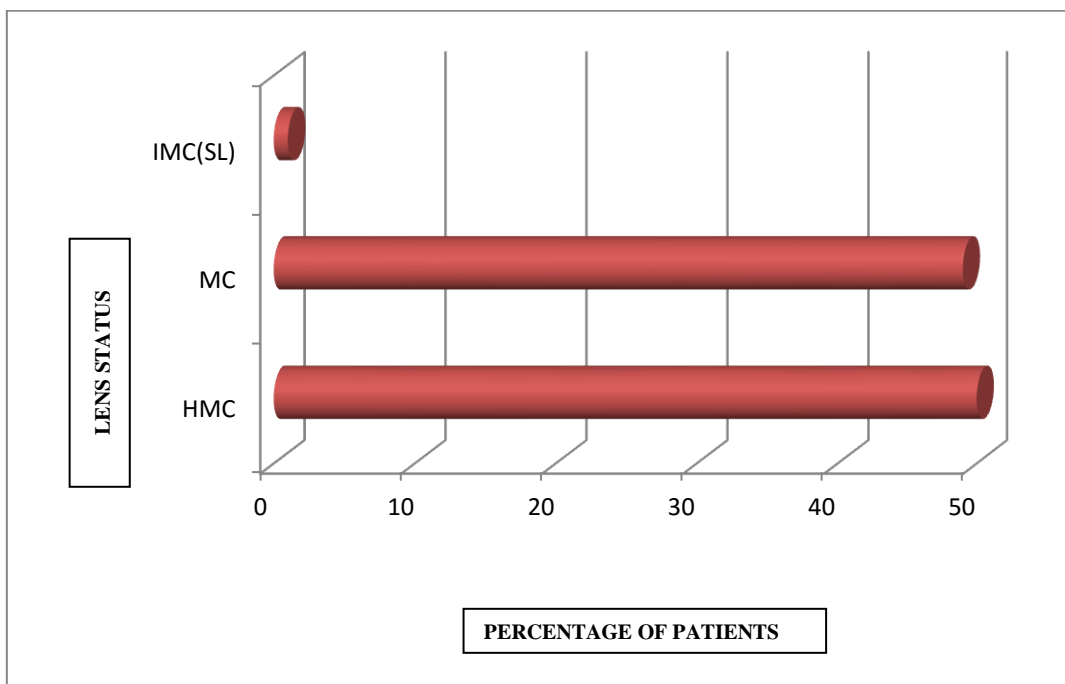
In our study, among 100 cases of lens induced glaucomas, **60%** cases were phacolytic glaucomas(PLG),**29%** were phacomorphic glaucomas(PMG),**10%** were lens particle glaucomas(LPG),**1%** was due to subluxated lens induced glaucoma(SLIG).

#### **6. LENS STATUS IN AFFECTED EYE:**

<b>LENS STATUS</b>	<b>NO OF EYES</b>	<b>PERCENTAGE</b>
HYPERMATURE CATARACT (HMC)	50	50
MATURE CATARACT(MC)	49	49
IMMATURE CATARACT (IMC)- SUBLUXATED LENS	01	01

**TABLE 6: TABLE SHOWING LENS STATUS IN AFFECTED EYE**





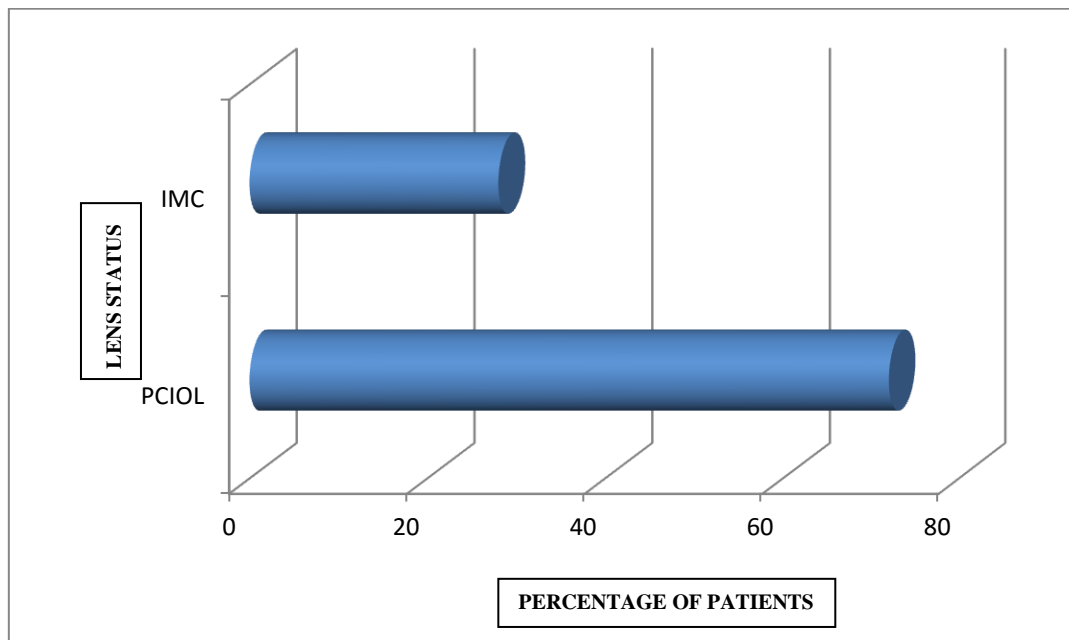
**CHART 6: CHART SHOWING LENS STATUS IN AFFECTED EYE**

In our study, among 100 affected eyes, **50%** had hyper mature cataract, **49%** had mature cataract, **1%** had immature cataract with subluxation.

**7. LENS STATUS IN OTHER EYE:**

LENS STATUS	NO OF EYES	PERCENTAGE
POSTERIOR CHAMBER IOL (PCIOL)	72	72
IMMATURE CATARACT (IMC)	28	28

**TABLE 7: TABLE SHOWING THE LENS STATUS IN OTHER EYE OF THE PATIENT**



**CHART 7: CHART SHOWING THE LENS STATUS IN OTHER EYE OF THE PATIENT**

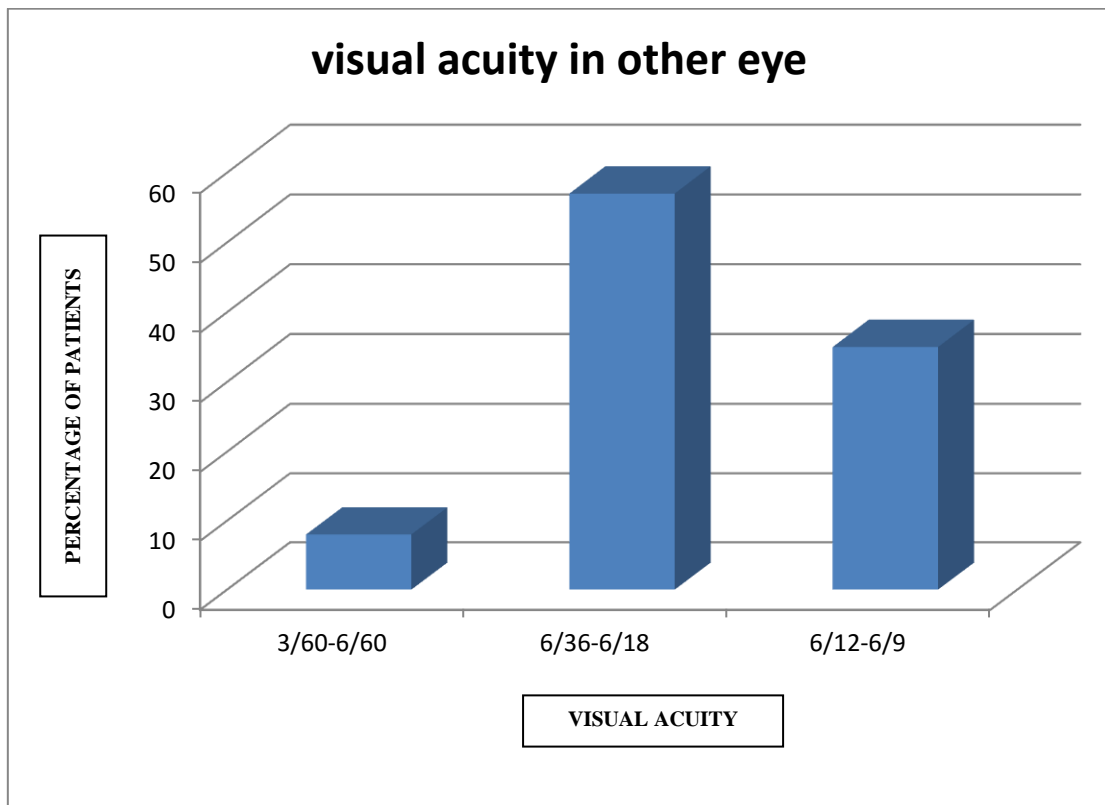
In our study, among 100 cases, the unaffected other eye had Posterior chamber IOL (PCIOL) in **72%** of cases and immature cataract in **28%**.

Maximum cases (**72%**) had **PCIOL** in other eye.

#### **8. VISUAL ACUITY IN OTHER EYE:**

<b>VISUAL ACUITY IN OTHER EYE</b>	<b>NO.OF EYES</b>	<b>PERCENTAGE</b>
<b>3/60-6/60</b>	8	8
<b>6/36-6/18</b>	57	57
<b>6/12-6/9</b>	35	35

**TABLE8: TABLE SHOWING VISUAL ACUITY IN OTHER EYE**



**CHART8: CHART SHOWING VISUAL ACUITY IN OTHER EYE**

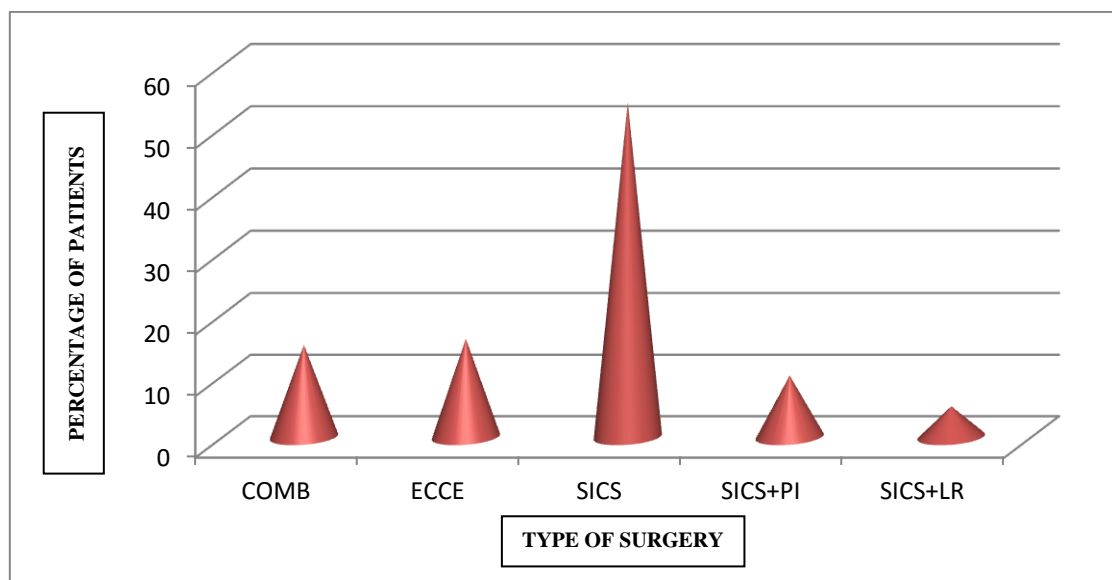
In our study, among 100 cases, visual acuity in other eye was in the range 3/60-6/60 in **8%** cases, 6/36-6/18 in **57%** cases, 6/12-6/9 in **35%** cases.

Maximum number of cases (**57%**) had a visual acuity in **6/36-6/18** range.

### 9. TYPE OF SURGERY DONE:

TYPE OF SURGERY	NO OF EYES	PERCENTAGE
COMBINED SURGERY (COMB)	15	15
EXTRA CAPSULAR CATARACT EXTRACTION (ECCE)	16	16
SMALL INCISION CATARACT SURGERY(SICS)	54	54
SMALL INCISION CATARACT SURGERY WITH PERIPHERAL IRIDECTOMY (SICS+PI)	10	10
SMALL INCISION CATARACT SURGERY WITH LENS REMOVAL (SICS+LR)	05	05

**TABLE 9: TABLE SHOWING TYPE OF SURGERY DONE IN LENS INDUCED GLAUCOMA**



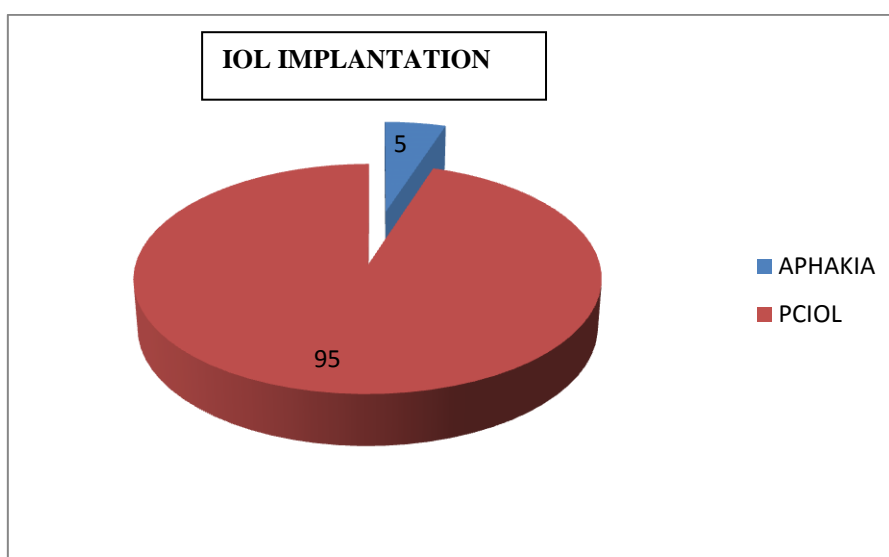
**CHART 9: CHART SHOWING TYPE OF SURGERY DONE IN LENS INDUCED GLAUCOMA**

In our study, among 100 cases of lens induced glaucomas, **15%** of cases were taken up for combined surgery(SICS with Trabeculectomy), **16%** of cases were taken up for Extra capsular cataract extraction (ECCE),**54%**of cases were taken up for small incision cataract surgery(SICS),**10%** of cases were taken up for small incision cataract surgery with peripheral iridectomy (SICS+PI), **5%** of cases were taken up for small incision cataract surgery with lens removal (SICS+LR).

#### 10. IOL IMPLANTATION:

IOL	NO OF EYES	PERCENTAGE
APHAKIA	5	5
PCIOL	95	95

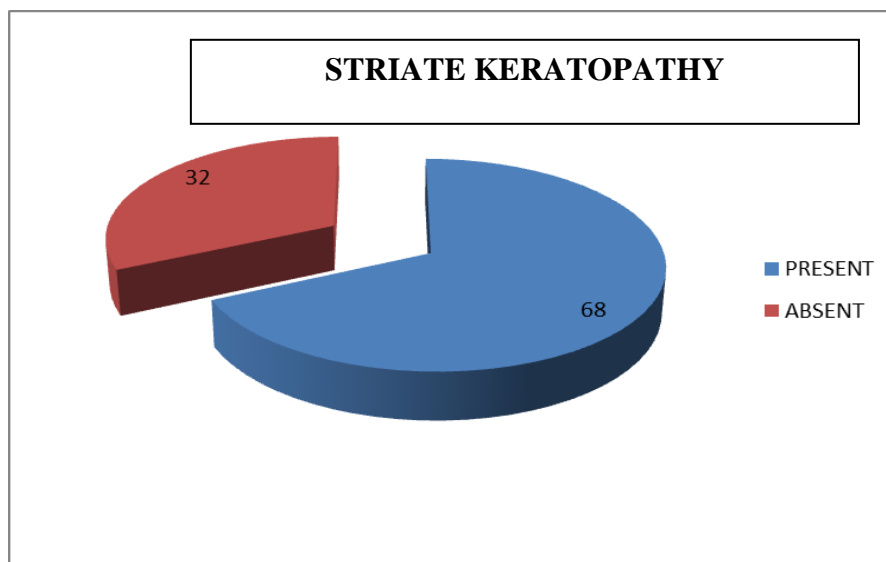
**TABLE 10: TABLE SHOWING IOL STATUS OF PATIENTS POST OPERATIVELY**



**CHART 10: CHART SHOWING IOL STATUS OF PATIENTS POST OPERATIVELY**

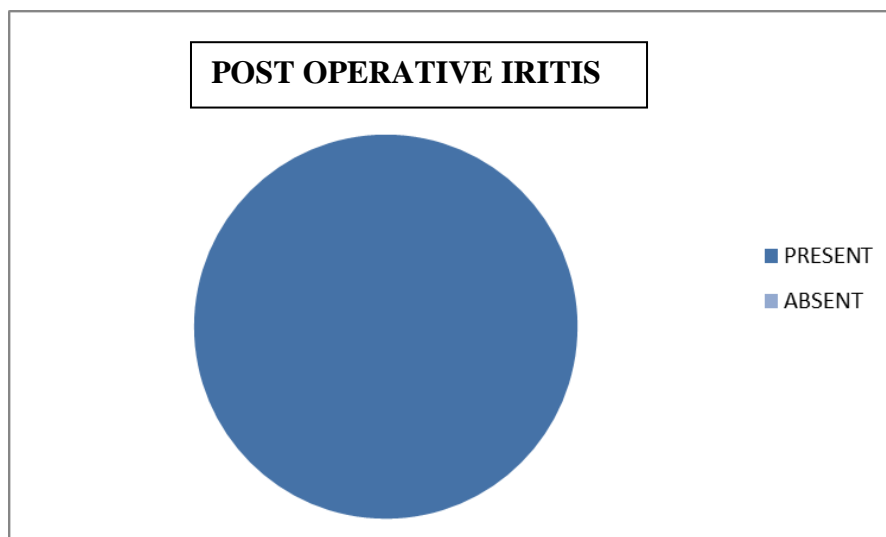
- In our study, among 100 eyes which were operated **95%** cases posterior chamber IOL (PCIOL) was implanted, **5%** of cases were left aphakic due to complications.

### 11. SURGICAL COMPLICATIONS:



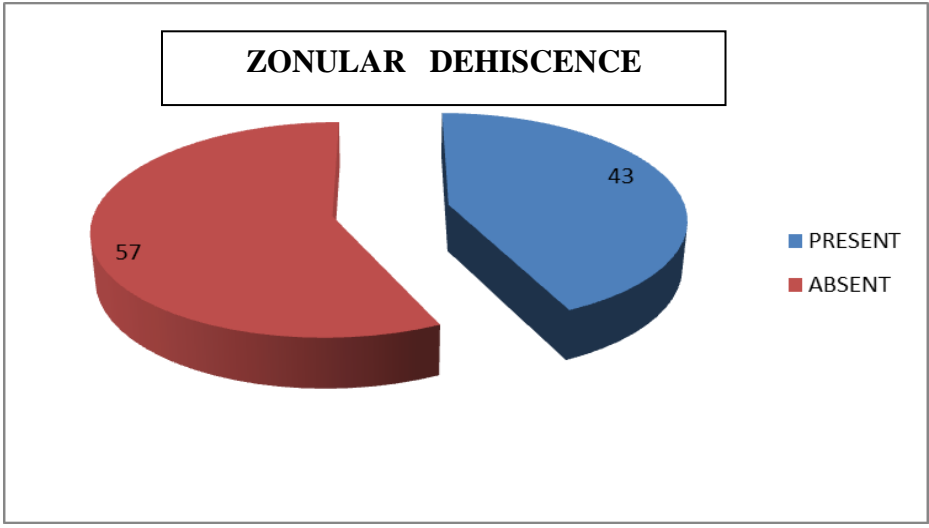
**CHART 11 A: CHART SHOWING % OF STRIATE KERATOPATHY**

In our study, among 100 eyes operated **68%** of cases had striate keratopathy post operatively.



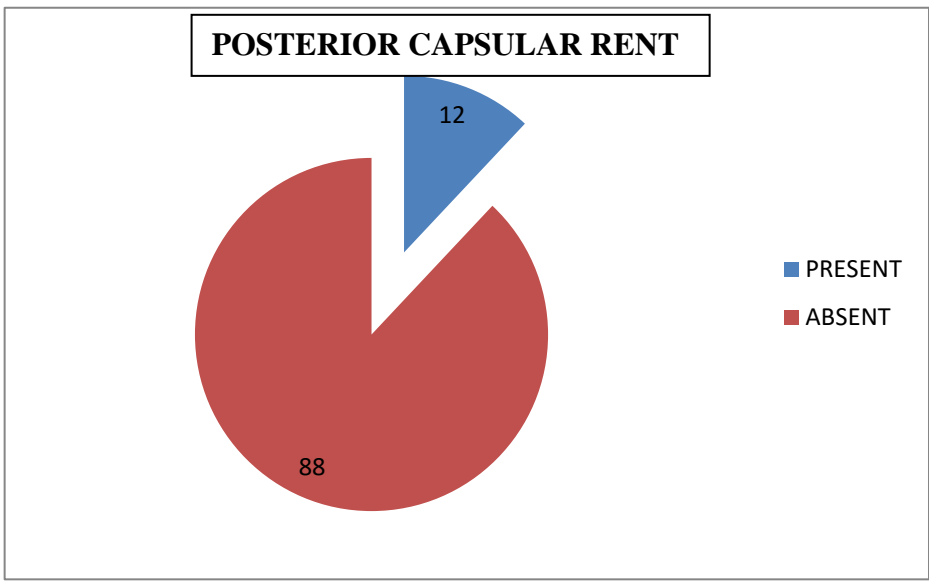
**CHART 11 B: CHART SHOWING % OF POST OPERATIVE IRITIS**

In our study, among 100 eyes operated, post-operative iritis was present in all cases (100%).



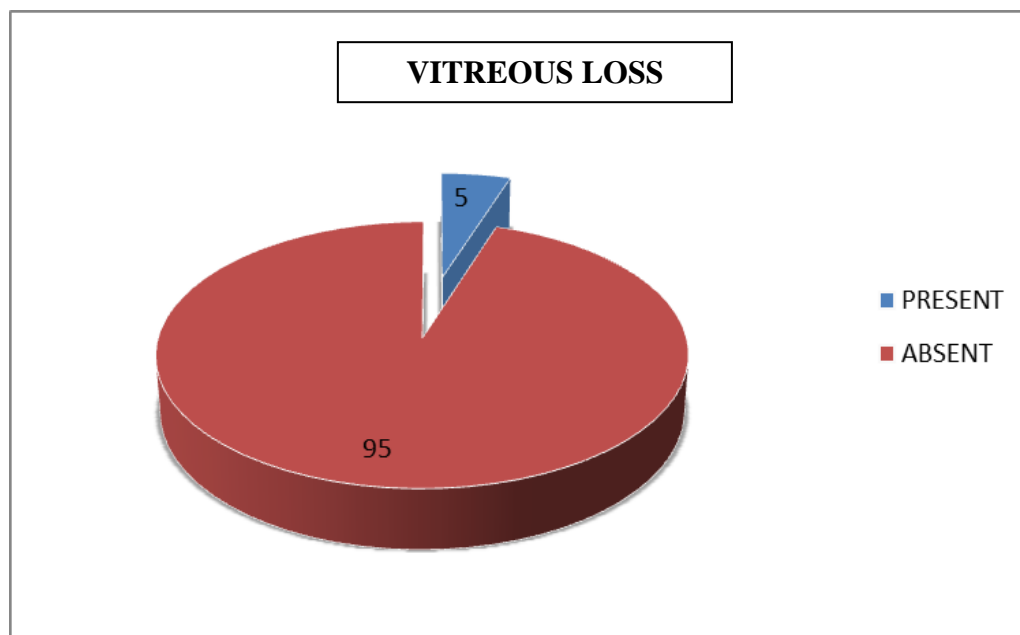
**CHART 11 C: CHART SHOWING % OF ZONULAR DEHISCENCE**

In our study, among 100 eyes operated, zonular dehiscence occurred in 43% cases.



**CHART 11 D: CHART SHOWING % OF POSTERIOR CAPSULAR RENT**

In our study, among 100 eyes operated 12% cases had posterior capsular rent.



**CHART 11 E: CHART SHOWING % OF VITREOUS LOSS**

In our study, among 100 eyes operated, 5% cases had vitreous loss.

## 12. POST OPERATIVE VISUAL OUTCOME:

VISION	POD 1	POD 3	POD 7	PO 2 <sup>ND</sup> WEEK	PO 4 <sup>TH</sup> WEEK	PO 6 <sup>TH</sup> WEEK
<b>HM-2/60</b>	28%	16%	5%	5%	5%	5%
<b>3/60-6/60</b>	72%	84%	75%	52%	35%	20%
<b>6/36-6/18</b>	0	0	20%	38%	45%	55%
<b>6/12-6/9</b>	0	0	0	5%	15%	20%

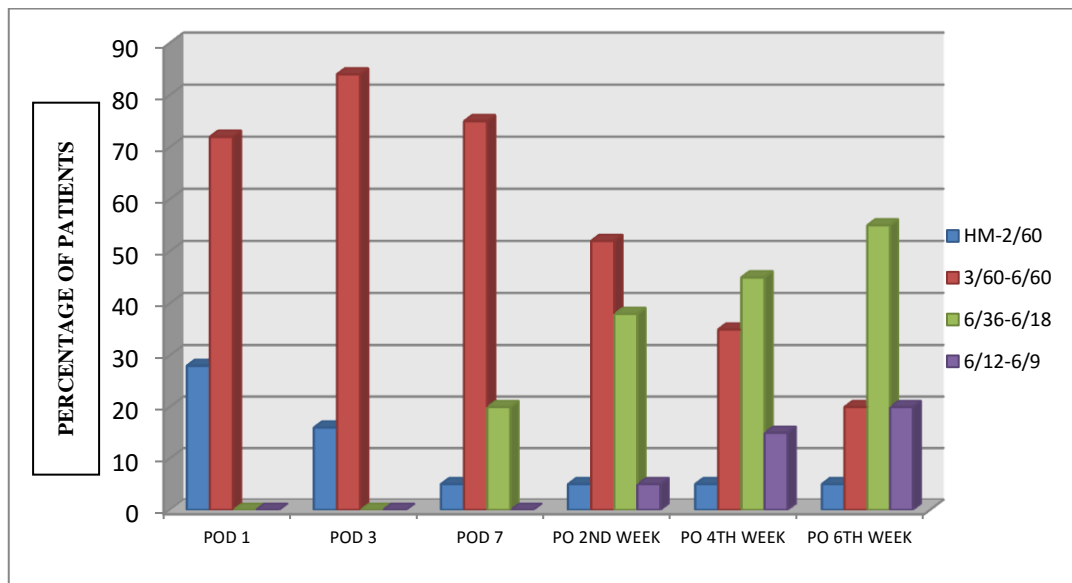
**TABLE 11: TABLE SHOWING VISUAL ACUITY IN POST OPERATIVE PERIOD**



In our study, among 100 cases:

- ✓ Visual acuity on **POST-OPERATIVE DAY 1: 28%** cases had vision of range HM-2/60 {HM- 5%; 1/60-9% ; 2/60 -14% } , **72%** cases had vision of range 3/60-6/60{ 3/60- 16%; 4/60-25%;5/60-21%;6/60-10% }
- ✓ Visual acuity on **POST-OPERATIVE DAY 3: 16%** cases had vision of range HM-2/60{HM- 1%; 1/60-9% ; 2/60 -6% } ,**84%**cases had vision of range 3/60-6/60{ 3/60- 21%; 4/60-14%;5/60- 15%;6/60-34% }
- ✓ Visual acuity on **POST-OPERATIVE DAY 7: 5%** cases had vision of range HM-2/60{HM- 0%; 1/60-5% ; 2/60 -0% } ,**75%** cases had vision of range 3/60-6/60{ 3/60- 10%; 4/60-17%;5/60-10%;6/60-38% } ,**20%**cases had vision of range 6/36-6/18{6/36-15%;6/24-5%;6/18-0% }
- ✓ Visual acuity on **POST-OPERATIVE 2<sup>ND</sup> WEEK : 5%** cases had vision of range HM-2/60{HM- 0%; 1/60-5% ; 2/60 -0% } ,**52%** cases had vision of range 3/60-6/60{ 3/60- 0%; 4/60-10%;5/60- 5%;6/60-37% } ,**38%** cases had vision of range 6/36-6/18{6/36-28%;6/24-10%;6/18-0% } ,**5%**cases had vision of range 6/12-6/9{ 6/12-5%,6/9-0% }

- ✓ Visual acuity on **POST-OPERATIVE 4th WEEK** : **5%** cases had vision of range HM-2/60{HM- 0%; 1/60-5% ; 2/60 -0%} ,**35%** cases had vision of range 3/60-6/60{ 3/60- 0%; 4/60-0%;5/60- 5%;6/60-30%} ,**45%** cases had vision of range 6/36-6/18{6/36-25%;6/24-20%;6/18-0%} ,**15%** cases had vision of range 6/12-6/9{ 6/12-15%,6/9-0% }
- ✓ Visual acuity on **POST-OPERATIVE 6th WEEK** : **5%** cases had vision of range HM-2/60{HM- 0%; 1/60-5% ; 2/60 -0%} ,**20%** cases had vision of range 3/60-6/60{ 3/60- 0%; 4/60-0%;5/60- 5%;6/60-15%} ,**55%** cases had vision of range 6/36-6/18{6/36-35%;6/24-10%;6/18-10%} ,**20%** cases had vision of range 6/12-6/9{ 6/12-20%,6/9-0% }.



**CHART 12: CHART SHOWING THE VISUAL OUTCOME IN EACH POSTOPERATIVE DAY /WEEK**

### 13. POST OPERATIVE IOP CONTROL:

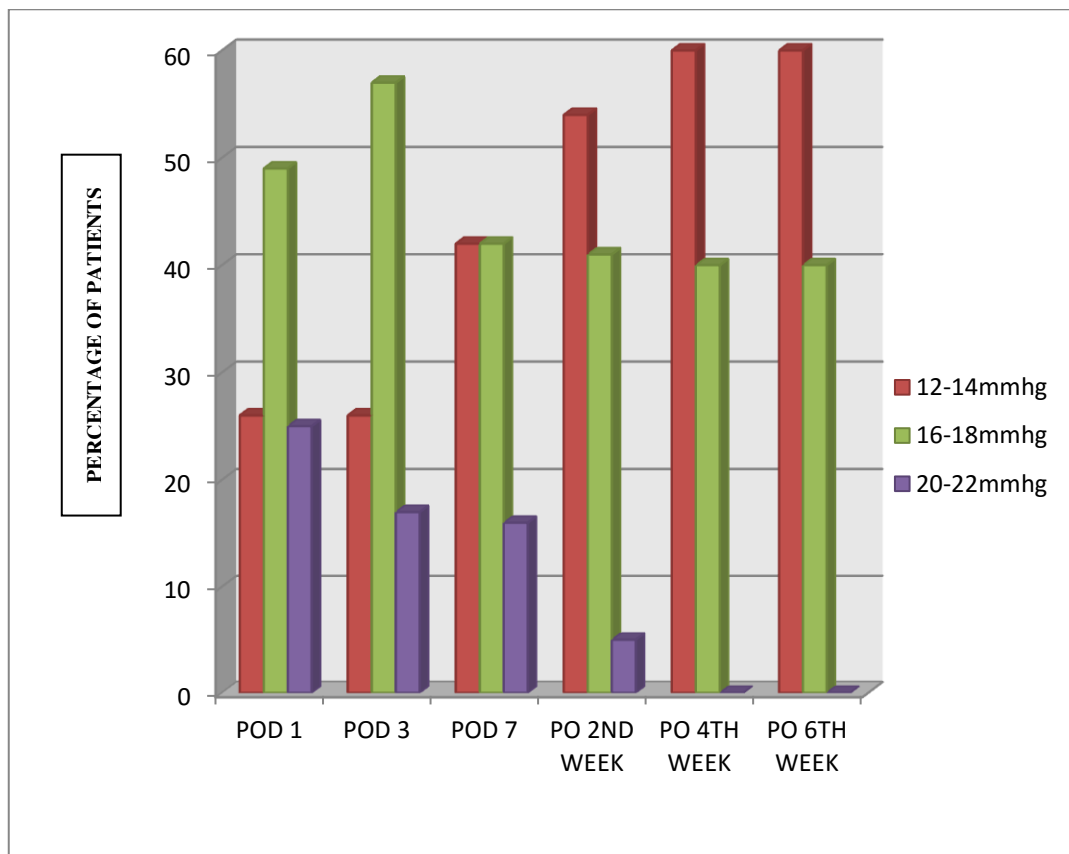
IOP (mmhg)	POD 1	POD 3	POD 7	PO 2 <sup>ND</sup> WEEK	PO 4 <sup>TH</sup> WEEK	PO 6 <sup>TH</sup> WEEK
<b>12-14</b>	26%	26%	42%	54%	60%	60%
<b>16-18</b>	49%	57%	42%	41%	40%	40%
<b>20-22</b>	25%	17%	16%	05%	0	0

**TABLE 12: TABLE SHOWING IOP REDUCTION IN POST OPERATIVE PERIOD**

In our study among 100 cases,

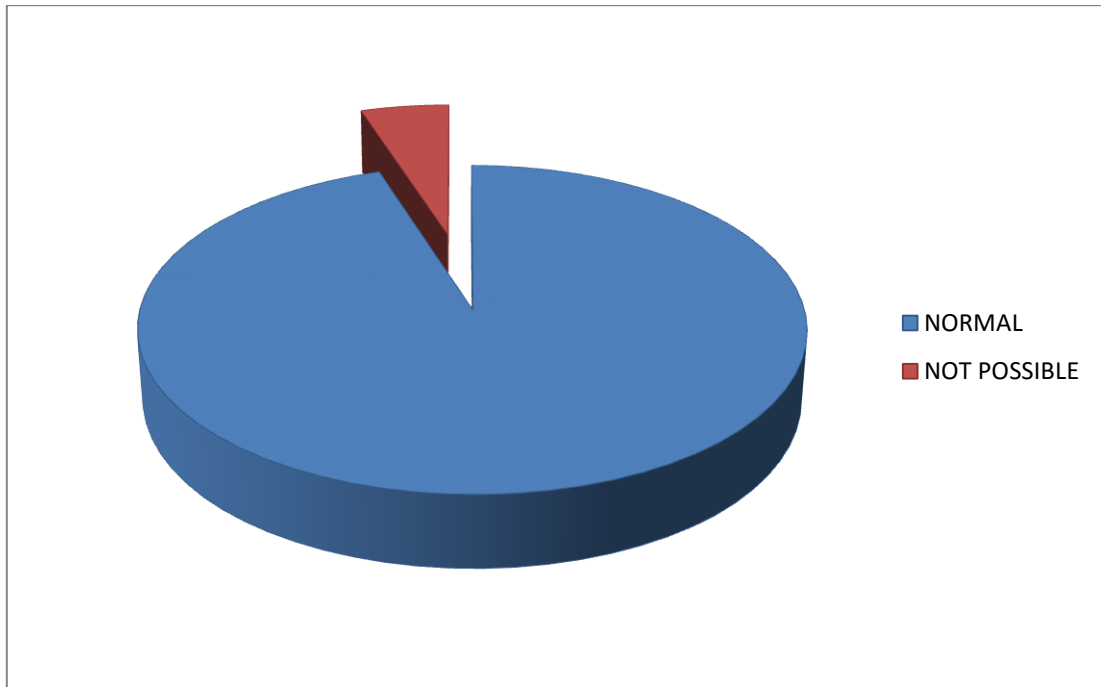
- ✓ On post-operative day 1, intraocular pressure( IOP) was in the range of 12-14mmhg in **26%** cases,16-18mmhg in **49%** cases,20-22mmhg in **25%** cases.
- ✓ On post-operative day 3, intraocular pressure( IOP) was in the range of 12-14mmhg in **26%** cases,16-18mmhg in **57%** cases,20-22mmhg in **17%** cases.
- ✓ On post-operative day 7 ,intraocular pressure( IOP) was in the range of 12-14mmhg in **42%**cases,16-18mmhg in **42%** cases,20-22mmhg in **16%** cases.

- ✓ On post-operative 2<sup>nd</sup> week, intraocular pressure( IOP) was in the range of 12-14mmhg in **54%** cases,16-18mmhg in **41%** cases,20-22mmhg in **5%** cases.
- ✓ On post-operative 4<sup>th</sup> week, intraocular pressure( IOP) was in the range of 12-14mmhg in **60%** cases,16-18mmhg in **40%** cases,20-22mmhg in 0% cases.
- ✓ On post-operative 6<sup>th</sup> week, intraocular pressure( IOP) was in the range of 12-14mmhg in **60%** cases,16-18mmhg in **40%** cases,20-22mmhg in 0% cases.



**CHART 13: CHART SHOWING THE IOP REDUCTION IN EACH POSTOPERATIVE DAY/WEEK**

#### 14. VISUAL FIELD EXAMINATION:



**CHART14: CHART SHOWING POSTOPERATIVE VISUAL FIELD EXAMINATION OF PATIENTS**

In our study, among 100 cases, at the end of 6<sup>th</sup> post-operative week visual field examination showed 95% with normal visual field, 5% of patients it could not be tested due to poor visual acuity.

## DISCUSSION

- 1) **Age**: In our study, Maximum numbers of cases (52%) were in the age group of 56 -60 years. In a study done by venkatesh prajna et al(1996) age group range was 43 -80years<sup>(16)</sup>.
- 2) **Sex**: In our study there was a slight male preponderance (59%). Previous studies showed a slight female preponderance but it was not statistically significant <sup>(16)</sup>. Sex does not affect the disease process or the treatment in lens induced glaucoma cases.
- 3) **Vision at the time of presentation**: Among 100 cases,51% patients presented with a vision of perception of light(PL), 48% patients presented with a vision of hand movements(HM), 1% patients presented with a vision of reading at 1 meter distance(1/60). Maximum number of cases presented with a very poor vision due to mature cataract and corneal edema. In previous studies 90% cases presented with perception of light vision<sup>(18)</sup>
- 4) **IOP at the time of presentation**: Maximum cases (47%) presented with an IOP of 28-32mmhg. IOP reduction should be done with medication before taking up for surgery. In a study done by venkatesh prajna et al (1996), IOP range was 22-70 mmhg<sup>(16)</sup>.

- 5) **Type of lens induced glaucoma:** In our study, among 100 cases of lens induced glaucomas, 60% cases were phacolytic glaucomas, 29% were phacomorphic glaucomas, 10% were lens particle glaucomas, 1% was due to subluxated lens induced glaucoma. Most of the previous studies were done only on phacolytic and phacomorphic glaucomas<sup>(16)(20)(25)(28)</sup>
- 6) **Lens status in affected eye:** In our study, among 100 affected eyes, 50% had hyper mature cataract, 49% had mature cataract, 1% had immature cataract with subluxation. Maximum cases had a hyper mature cataract. Previous studies also shows 92% cases were presenting with hyper mature cataract<sup>(20)</sup>
- 7) **Lens status in other eye:** In our study, Maximum cases (72%) had PCIOL in other eye. This was an important factor for late presentation to the hospital. Since patient was operated in other eye and had good vision they ignored the visual loss of the fellow eye and presented to hospital only when they had symptoms like pain and redness.
- 8) **Visual acuity in other eye:** Maximum number of cases (57%) had a visual acuity in 6/36-6/18 range and 6/12-6/9 in 35% cases. Because of good vision in other eye most of the patients are comfortable with the routine activity and presented late to hospital only when they developed pain and redness.

9) **Type of surgery done:** In our study, among 100 cases of lens induced glaucomas, 15% of cases were taken up for combined surgery(SICS with Trabeculectomy), 16% of cases were taken up for Extra capsular cataract extraction (ECCE),54% of cases were taken up for small incision cataract surgery(SICS),10% of cases were taken up for small incision cataract surgery with peripheral iridectomy (SICS+PI), 5% of cases were taken up for small incision cataract surgery with lens removal (SICS+LR). The type of surgery depends on the type of lens induced glaucoma and decided on the patient's individual condition.

10)**IOL implantation:** In our study, postoperatively 95% cases posterior chamber IOL was implanted, 5% cases were left aphakic due to surgical complications and planned for secondary IOL implantation in second sitting after inflammation reduces.

The choice of secondary IOL can be iris claw lens or a scleral fixation lens.

11)**Surgical complications:**

- 68% of cases had striate keratopathy.
- Post-operative iritis was present in all cases (100%)



- zonular dehiscence occurred in 43% cases,
- 12% cases had posterior capsular rent and 5% cases had vitreous loss.

All these complications caused reduced visual acuity in early post-operative period. Patients who had corneal endothelial touch during surgery developed striate keratopathy post operatively and were treated with 5% hypertonic sodium chloride eye drops 4 times daily.

In cases of severe post-operative iritis, subconjunctival dexamethasone injection of 0.5cc is given, cycloplegics were used (cyclopentolate eye drops TDS).

## 12) **Post-operative visual outcome:**

At the end of six weeks the visual acuity for maximum number of cases (55%) was in the range 6/36-6/18, 20% cases had vision of range 3/60-6/60, 20% cases had vision of range 6/12-6/9. Hence visual improvement occurred in 95% of cases at the end of sixth post-operative week. This is a statistically significant ( $p < 0.5$ ) improvement.

- Among the 20% cases with a vision of 6/12, 15% were phacolytic glaucoma, 5% were lens particle glaucoma.
- Out of 10 **lens particle glaucoma cases**, 50 % ( 5 cases) had a good vision of 6/12 when compared to other types of lens induced glaucoma.
- 5% of cases had reduced vision due to aphakia and all the 5 cases had a vision in range of 6/18-6/12 with +10DSph correction hence, planned for a secondary IOL implantation later after inflammation subsides.

13) **IOP reduction**: at the end of 6th post-operative week, intraocular pressure (IOP) was in the range of 12-14mmhg in 60% cases, 16-18mmhg in 40% cases.

Hence 100% cases had reduction in intraocular pressure following surgery in lens induced glaucoma. Hence surgery is the gold standard treatment for all lens induced glaucomas.

14) **Visual field examination**: Among 100 cases, at the end of 6th post-operative week visual field examination showed 95% with normal visual field, 5% of patients it could not be tested due to poor visual acuity. Since all cases are promptly treated on time and intraocular pressure was controlled visual field loss was prevented.

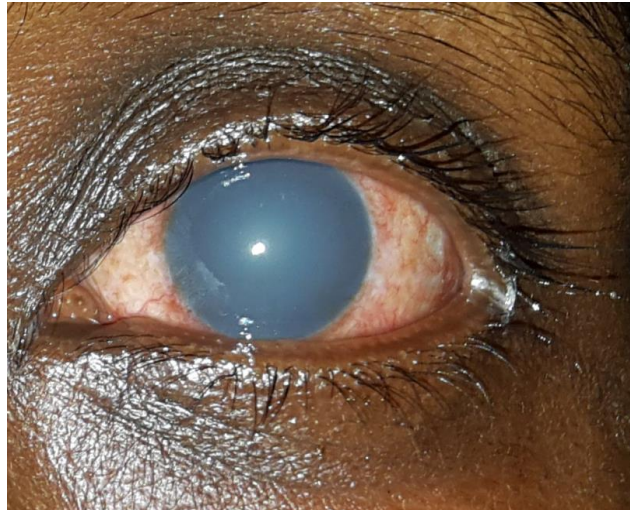
## CONCLUSION

- ✓ Lens induced glaucoma occurs due to long standing cataractous lens which becomes hyper mature/mature and also due to trauma.
- ✓ In our study, most of the patients had good vision in fellow eye and PCIOL status. This shows that patients ignored the reduced vision in affected eye due to good vision in fellow eye so their daily life was not affected until they developed symptoms.
- ✓ Hence it is important to educate the patient postoperatively, to regularly follow up and examine the fellow eye and advice cataract surgery promptly before complications develop.
- ✓ Most of the patients present with lens induced glaucoma were from a rural area where the surgical facilities are not easily available.
- ✓ Eye camps should be conducted in remote villages and screened for cataract and operated before complications occur.

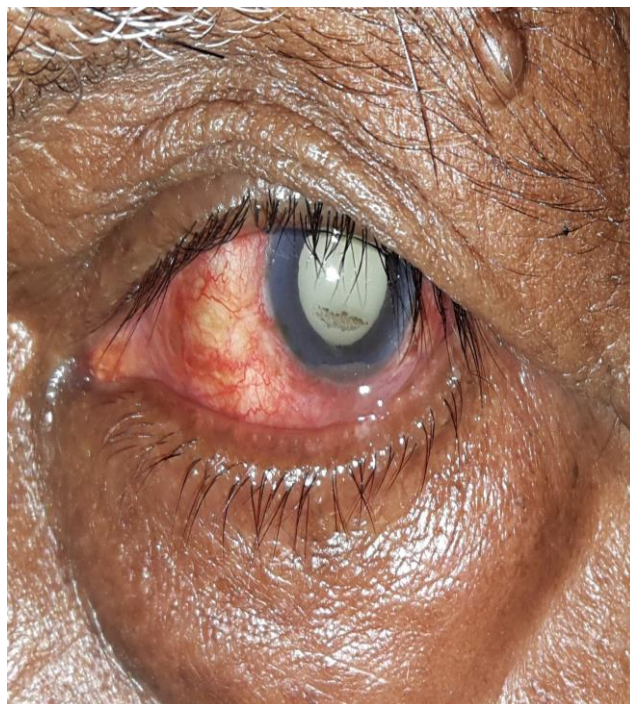
- ✓ In lens induced glaucoma, surgery is the main stay of treatment after adequate control of intraocular pressure and inflammation with medications.
  
- ✓ Following surgery, intraocular pressure reduction occurs in all cases and visual improvement occurs in 95% cases.

## CLINICAL PHOTOGRAPHS

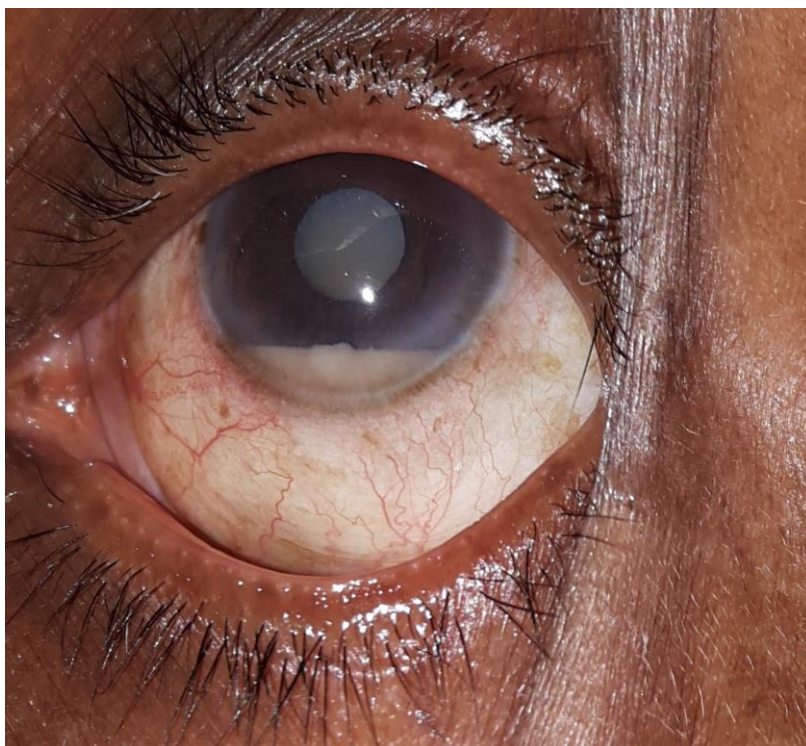
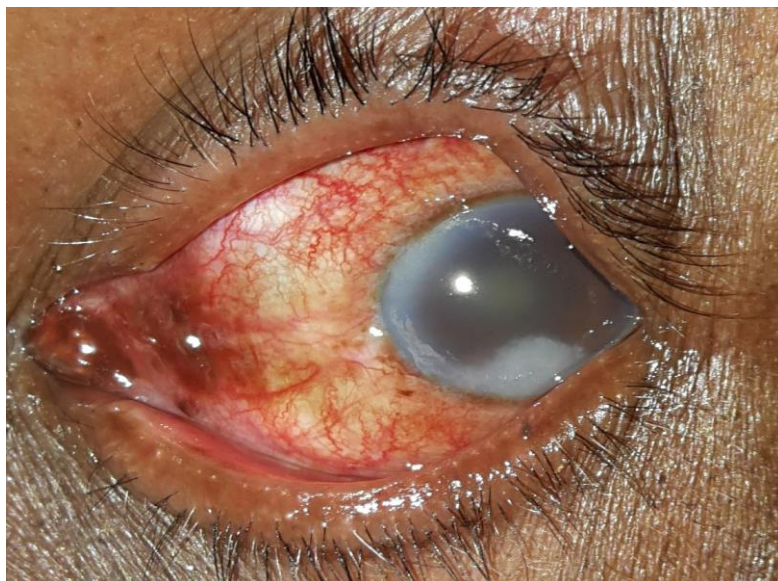
### PHACOLYTIC GLAUCOMA



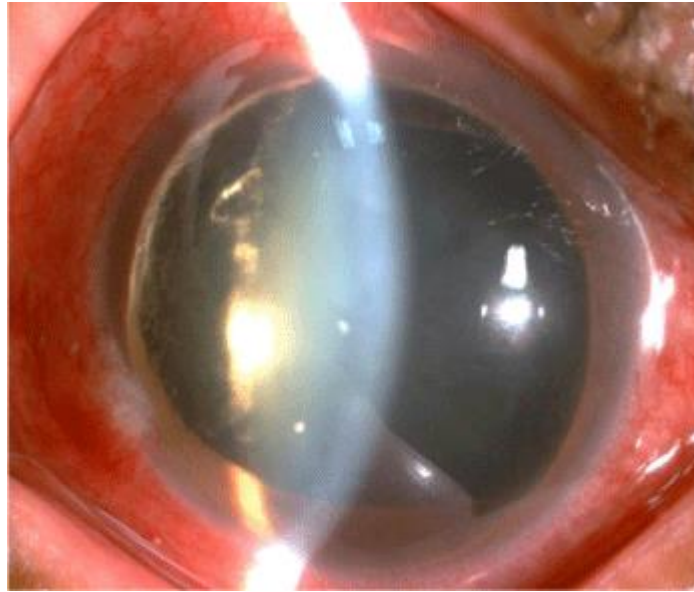
### PHACOMORPHIC GLAUCOMA



## LENS PARTICLE GLAUCOMA

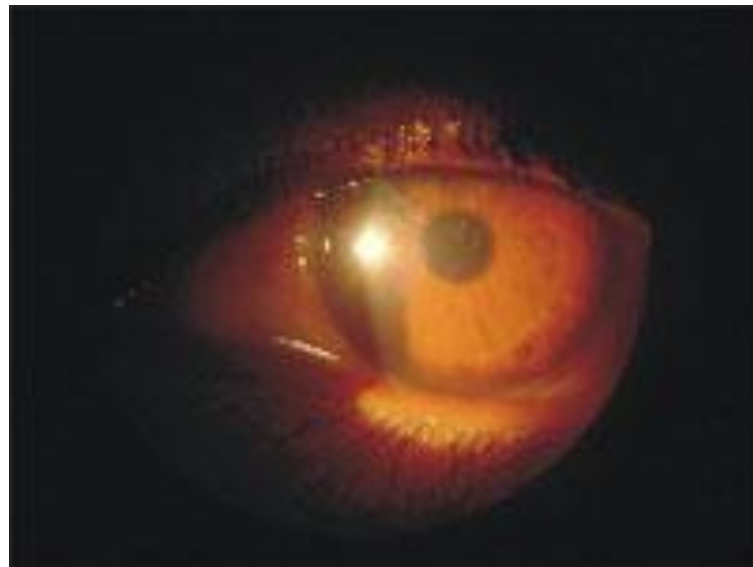


**GLAUCOMA DUE TO SUBLUXATED LENS**

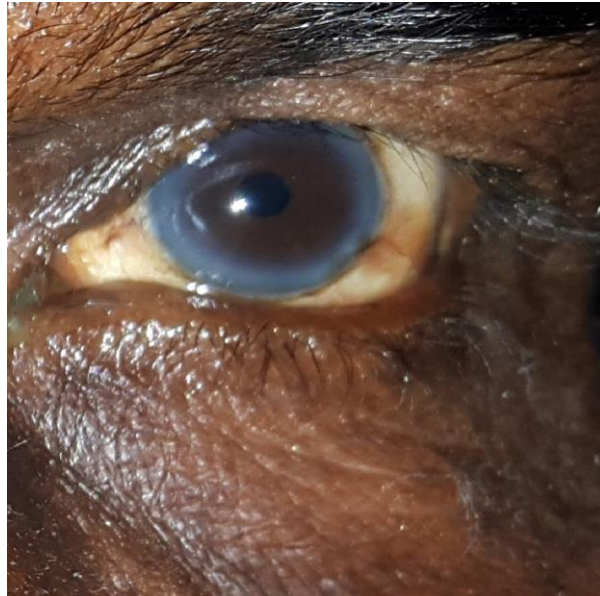


**POST OPERATIVE PERIOD**

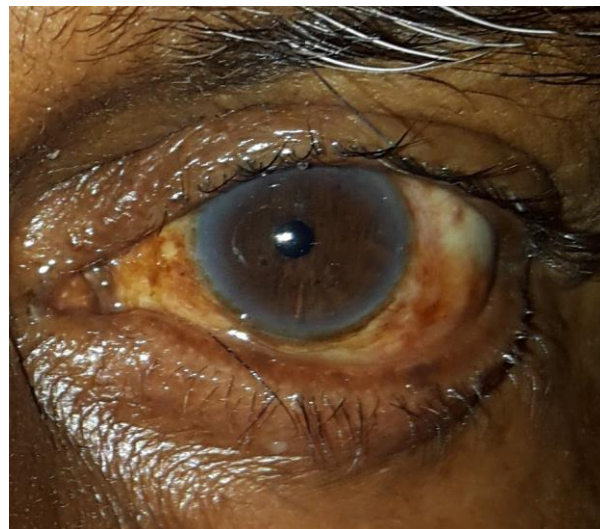
**POST OP DAY3**



**POST OP FOURTH WEEK**

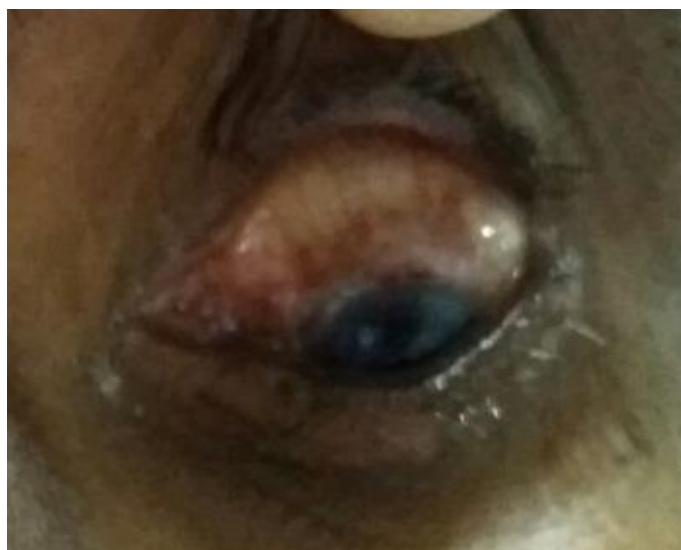


**POST OP SIXTH WEEK**





**POST OPERATIVE PICTURE SHOWING  
THE BLEB STATUS**



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## PROFORMA

CASE NUMBER:

1. Name:                      Age/sex :                      Mobile no:

OP No/Date:

Place:

2.     Symptoms: ( Duration )

Defective vision

Pain

Redness

Photophobia

Any other symptoms:

3.     Past history - History of any intraocular surgery/trauma

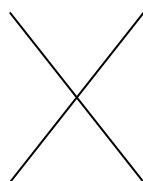
4.     Medical history - diabetes /hypertension/IHD/bronchial  
asthma/chronic disease/steroid usage (long term)

5.     Family history-similar history in family (subluxated /dislocated  
lens in non-traumatic cases)

## 6. Ocular Examination:

	RE	LE
Lids		
Conjunctiva		
Cornea		
Ant chamber: Depth Cells/flare Lens particles		
Iris		
Pupil: Size shape reaction		
Lens :	Immature Mature Hypermature Subluxated dislocated	Immature Mature Hypermature Subluxated dislocated

Gonioscopy: Schaffer RE



LE



Vision: (BCVA)

RE:

LE:

Intraocular pressure:

(GAT/Rebound tonometry) RE: LE:

Fundus: RE: media: disc and vessels:

LE: media: disc and vessels:

Diagnosis:

Surgical details: Nature of surgery Manual SICS/ ECCE/ Combined /  
lens removal with secondary IOL

Complications:- 1. Corneal endothelial injury (striate keratopathy)  
2.Zonular dehiscence 3.PC rent 4.Vitreous loss 5.Post op iritis

Post op vision (BCVA) :

Day 1                      Day 3                      Day 7

Post op IOP: (NCT)

Day 1                      Day3                      Day 7

Follow up visits: 2nd week              4th week              6th week

Visual acuity

Anterior segment

Fundus

IOP

Gonioscopy

Fields (AP/ manual)



## KEY TO MASTER CHART

RE - RIGHT EYE, LE – LEFT EYE

IP NO – IN PATIENT NO

### **SEX:**

M - MALE

F - FEMALE

### **CORNEA:**

C – CLEAR

E – EDEMA

### **VISION AND INTRAOCULAR PRESSURE:**

HM- HAND MOVEMENTS

PL-PERCEPTION OF LIGHT

IOP-INTRAOCULAR PRESSURE

### **GONIOSCOPY:**

0,1,2,3 – SHAFFER’S GRADING

PAS-PERIPHERAL ANTERIOR SYNECHIAE

NV-NO VIEW

**ANTERIOR CHAMBER (A.C) :**

ND – NORMAL DEPTH

S – SHALLOW

C- CELLS +

F- FLARE+

LP- LENS PARTICLES

**PUPIL:**

RTL- REACTING TO LIGHT

NRTL- NOT REACTING TO LIGHT

**FUNDUS:**

NV-NO VIEW

VH – VIEW HAZY

CD – CUP DISC RATIO

**BSCAN:**

N- NORMAL

**LENS:**

IMC – IMMATURE CATARACT

MC – MATURE CATARACT

HMC – HYPER MATURE CATARACT

PCIOL - POSTERIOR CHAMBER IOL

SL – SUBLUXATED LENS

**DIAGNOSIS:**

PLG-PHACOLYTIC GLAUCOMA

PMG-PHACOMORPHIC GLAUCOMA

LPG-LENS PARTICLE GLAUCOMA

SLIG (SL)-SECONDARY LENS INDUCED GLAUCOMA DUE TO  
SUBLUXATED LENS

**SURGERY:**

SICS – SMALL INCISION CATARACT SURGERY

ECCE- EXTRA CAPSULAR CATARACT EXTRACTION

PI – PERIPHERAL IRIDECTOMY

COMB- COMBINED SURGERY (SICS+TRAB)

**SURGICAL COMPLICATIONS:**

SK-STRIATE KERATOPATHY

ZD – ZONULAR DEHISCENCE

PCR – POSTERIOR CAPSULAR RENT

VL – VITREOUS LOSS

POI – POSTOP IRITIS

**FIELDS:**

N- NORMAL

NP- NOT POSSIBLE

SL NO	NAME	AGE	SEX	IP NUM	EYE	VN	IOP	CORNEA	AC	PUPIL	LENS	GONIO	CDR	BSCAN	DIAGNOSIS	SURGERY	SURGICAL COMPLICATIONS					IOL	POD1		POD3		POD 7		PO 2ND WK		PO 4TH WK		PO 6TH WK		FIELDS	
																	SK	POI	ZD	VL	PCR		VN	IOP	VN	IOP	VN	IOP	VN	IOP	VN	IOP	VN	IOP		VN
1	SUBBARAO	56	M	65340	RE	HM	30	E	ND C+F+	NRTL	HMC	NV	NV	N	RE PLG	SICS	+	+	+	-	-	PCIOL	3/60	14	6/60	12	6/24	12	6/12	12	6/12	12	6/12	12	N	
2	ADIMOOLAM	57	M	12453	RE	PL	26	E	ND C+F+	SRTL	MC	NV	NV	N	RE PLG	SICS	+	+	-	-	-	PCIOL	2/60	14	3/60	14	6/60	14	6/36	14	6/24	12	6/12	12	N	
3	BAGAVATHY	60	F	92143	RE	6/12	14	C	ND	RTL	IMC	3	0.3																							
4	VELLAPAN	58	M	1267	RE	HM	28	E	S	NRTL	MC	1 PAS	NV	N	LE PMG	COMB	+	+	+	-	+	PCIOL	1/60	18	3/60	18	5/60	18	6/36	16	6/36	16	6/36	16	N	
5	MYTHILI	56	F	1468	RE	PL	26	E	ND C+F+	NRTL	MC	NV	NV	N	RE PLG	SICS	+	+	-	-	-	PCIOL	3/60	12	3/60	12	4/60	12	6/60	12	6/36	12	6/36	12	N	
6	MUNUSAMY	62	M	37860	RE	6/24	16	C	ND	RTL	PCIOL	3	0.3																							
7	PARVATHY	66	F	2459	RE	PL	26	E	ND C+F+	NRTL	HMC	NV	NV	N	RE PLG	SICS	-	+	-	-	-	PCIOL	4/60	14	6/60	12	6/36	12	6/36	12	6/12	12	6/12	12	N	
8	MURALI	58	M	7890	RE	HM	32	E	S	NRTL	MC	1 PAS	NV	N	RE PMG	COMB	+	+	-	-	-	PCIOL	3/60	16	4/60	16	6/60	14	6/36	14	6/36	14	6/36	14	N	
9	KUMARVEL	68	M	12367	RE	5/60	16	C	ND	RTL	IMC	3	0.4																							
10	SOLAI	60	M	1480	RE	3/60	14	C	ND	RTL	IMC	3	VH																							
11	RATHNAM	57	M	1293	RE	HM	40	E	ND C+F+	NRTL	HMC	NV	NV	N	RE PLG	ECCE	-	+	-	-	-	PCIOL	6/60	12	6/60	12	6/60	12	6/36	12	6/24	12	6/18	12	N	
12	RAJI	65	F	1356	RE	HM	28	E	ND LP+	NRTL	HMC	NV	NV	N	RE LPG	SICS	-	+	-	-	-	PCIOL	5/60	14	5/60	12	6/60	12	6/60	12	6/36	12	6/24	12	N	
13	MALIGAI	55	F	1908	RE	PL	38	E	S	NRTL	MC	1 PAS	NV	N	RE PMG	COMB	+	+	+	-	-	PCIOL	4/60	18	4/60	16	5/60	14	6/60	14	6/60	14	6/36	14	N	
14	SURYAN	63	M	1460	RE	6/36	18	C	ND	RTL	IMC	3	0.3																							
15	KAMALI	70	F	2701	RE	PL	28	E	ND C+F+	NRTL	HMC	NV	NV	N	RE PLG	ECCE	-	+	+	-	-	PCIOL	6/60	18	6/60	18	6/60	18	6/36	16	6/24	14	6/24	14	N	
16	SANTHANAM	59	M	4780	RE	6/18	20	C	ND	RTL	PCIOL	3	0.3																							
17	SUNDARI	61	F	1269	RE	PL	40	E	ND C+F+	NRTL	HMC	NV	NV	N	RE PLG	SICS	-	+	+	-	-	PCIOL	3/60	18	3/60	18	4/60	18	4/60	18	5/60	18	5/60	18	N	
18	LALITHA	56	F	1904	RE	PL	30	E	ND C+F+	NRTL	HMC	NV	NV	N	RE PLG	SICS	+	+	+	-	-	PCIOL	2/60	16	2/60	16	3/60	14	4/60	14	6/60	14	6/60	14	N	
19	PARI	56	M	2360	RE	6/12	18	C	ND	RTL	PCIOL	3	0.3																							
20	KRISHNAN	69	M	1573	RE	PL	38	E	ND C+F+	NRTL	MC	NV	NV	N	LE PLG	ECCE	-	+	-	-	-	PCIOL	5/60	18	5/60	18	6/60	16	6/60	16	6/36	16	6/36	16	N	
21	KATHIR	51	M	9807	RE	HM	28	E	ND C+F+	NRTL	HMC	NV	NV	N	RE PLG	SICS	-	+	-	-	-	PCIOL	3/60	14	6/60	14	6/24	14	6/12	12	6/12	12	6/12	12	N	
22	MANIVANNAN	78	M	567	RE	PL	30	E	ND C+F+	SRTL	MC	NV	NV	N	RE PLG	SICS	+	+	-	-	-	PCIOL	2/60	14	3/60	14	6/60	14	6/36	14	6/24	12	6/12	12	N	
23	KUMARI DEVI	60	F	678	RE	6/36	14	C	ND	RTL	IMC	3	0.3																							
24	VILLALAN	67	M	342	RE	HM	30	E	S	NRTL	MC	1 PAS	NV	N	LE PMG	COMB	+	+	+	-	+	PCIOL	1/60	18	3/60	18	5/60	18	6/36	16	6/36	16	6/36	16	N	
25	PANDIAMMAL	56	F	1207	RE	HM	30	E	ND C+F+	NRTL	HMC	NV	NV	N	LE PLG	SICS	+	+	-	-	-	PCIOL	4/60	14	6/60	14	6/36	12	6/24	12	6/24	12	6/18	12	N	

SL NO	NAME	AGE	SEX	IP NUM	EYE	VN	IOP	CORNEA	AC	PUPIL	LENS	GONIO	CDR	BSCAN	DIAGNOSIS	SURGERY	SURGICAL COMPLICATIONS					IOL	POD1		POD3		POD7		PO 2ND WK		PO 4TH WK		PO 6TH WK		FIELDS		
																	SK	POI	ZD	VL	PCR		VN	IOP	VN	IOP	VN	IOP	VN	IOP	VN	IOP	VN	IOP		VN	IOP
26	MANIVARMAN	59	M	1048	RE	6/24	18	C	ND	RTL	PCIOL	3	0.3								PCIOL	1/60	16	1/60	16	3/60	16	5/60	14	6/60	14	6/36	14	N			
					LE	HM	28	E	ND C+F+	NRTL	MC	NV	NV	N	LE PLG	SICS	+	+	+	-	-																
27	PARVATHAM	62	F	8902	RE	PL	26	E	ND C+F+	NRTL	HMC	NV	NV	N	RE PLG	SICS	-	+	-	-	-	PCIOL	4/60	14	6/60	12	6/36	12	6/36	12	6/12	12	6/12	12	N		
					LE	6/36	18	C	ND	RTL	PCIOL	3	0.3																								
28	PICHAI	63	M	2123	RE	HM	32	E	S	NRTL	MC	1 PAS	NV	N	RE PMG	COMB	+	+	+	-	-	PCIOL	3/60	16	4/60	16	6/60	14	6/36	14	6/36	14	6/36	14	N		
					LE	6/18	18	C	ND	RTL	PCIOL	3	0.3																								
29	KOTAI	72	M	12367	RE	5/60	20	C	ND	RTL	IMC	3	0.4																								
					LE	PL	26	E	ND LP+	NRTL	HMC	NV	NV	N	LE LPG	SICS	+	+	-	-	-	PCIOL	5/60	16	6/60	16	6/36	16	6/24	14	6/12	14	6/12	14	N		
30	PACHAI	68	M	1367	RE	5/60	14	C	ND	RTL	IMC	3	VH																								
					LE	HM	34	E	S	NRTL	MC	NV	NV	N	LE PMG	SICS+LR	+	+	+	+	+	APHAKIA	HM	20	1/60	20	1/60	20	1/60	16	1/60	16	1/60	16	NP		
31	LAKSHMAN	57	M	670	RE	HM	40	E	ND C+F+	NRTL	HMC	NV	NV	N	RE PLG	ECCE	-	+	-	-	-	PCIOL	6/60	12	6/60	12	6/60	12	6/36	12	6/24	12	6/18	12	N		
					LE	6/24	12	C	ND	RTL	PCIOL	3	0.4																								
32	RAJKUMARI	70	F	1893	RE	HM	28	E	ND LP+	NRTL	HMC	NV	NV	N	RE LPG	SICS	-	+	+	-	-	PCIOL	5/60	14	5/60	12	6/60	12	6/60	12	6/36	12	6/24	12	N		
					LE	6/24	12	C	ND	RTL	PCIOL	3	0.3																								
33	MANOGARI	59	F	1908	RE	PL	38	E	S	NRTL	MC	1 PAS	NV	N	RE PMG	COMB	+	+	-	-	-	PCIOL	4/60	18	4/60	16	5/60	14	6/60	14	6/60	14	6/36	14	N		
					LE	6/60	16	C	ND	RTL	IMC	3	0.4																								
34	VARADAN	63	M	790	RE	6/36	18	C	ND	RTL	IMC	3	0.3																								
					LE	HM	38	E	S	NRTL	MC	NV	NV	N	LE PMG	SICS+PI	+	+	+	-	-	PCIOL	5/60	20	6/60	20	6/60	20	6/60	16	6/60	16	6/36	16	N		
35	KAMESWARI	55	F	2701	RE	PL	28	E	ND C+F+	NRTL	HMC	NV	NV	N	RE PLG	ECCE	-	+	-	-	-	PCIOL	6/60	18	6/60	18	6/60	18	6/36	16	6/24	14	6/24	14	N		
					LE	6/24	18	C	ND	RTL	PCIOL	3	0.4																								
36	SUDARMANI	60	M	1256	RE	6/18	20	C	ND	RTL	PCIOL	3	0.3																								
					LE	PL	36	E	S	NRTL	MC	NV	NV	N	LE PMG	SICS+PI	+	+	-	-	-	PCIOL	5/60	20	5/60	20	6/60	20	6/60	20	6/60	18	6/60	18	N		
37	KANAGI	61	F	6789	RE	PL	38	E	ND C+F+	NRTL	HMC	NV	NV	N	RE PLG	SICS	+	+	+	-	-	PCIOL	3/60	18	3/60	18	4/60	18	4/60	18	5/60	18	5/60	18	N		
					LE	6/12	18	C	ND	RTL	PCIOL	3	0.3																								
38	LAKSHMI	56	F	6704	RE	PL	30	E	ND C+F+	NRTL	HMC	NV	NV	N	RE PLG	SICS	+	+	-	-	-	PCIOL	2/60	16	2/60	16	3/60	14	4/60	14	6/60	14	6/60	14	N		
					LE	6/18	16	C	ND	RTL	PCIOL	3	0.3																								
39	PUSHPPAM	56	F	7845	RE	6/12	18	C	ND	RTL	PCIOL	3	0.3																								
					LE	PL	38	E	ND C+F+	NRTL	MC	NV	NV	N	LE PLG	ECCE	-	+	-	-	-	PCIOL	5/60	18	5/60	18	6/60	16	6/60	16	6/36	16	6/36	16	N		
40	KUPPU	59	M	8967	RE	6/18	16	C	ND	RTL	PCIOL	3	0.4																								
					LE	HM	30	E	ND C+F+	NRTL	HMC	NV	NV	N	LE PLG	SICS	+	+	+	-	-	PCIOL	4/60	20	4/60	16	4/60	16	6/60	16	6/60	16	6/60	16	N		
41	MICHAEL	56	M	589	RE	HM	30	E	ND C+F+	NRTL	HMC	NV	NV	N	RE PLG	SICS	-	+	-	-	-	PCIOL	4/60	18	6/60	16	6/24	16	6/12	14	6/12	14	6/12	14	N		
					LE	6/18	16	C	ND	RTL	PCIOL	3	0.3																								
42	AMARAN	64	M	1537	RE	PL	26	E	ND C+F+	SRTL	MC	NV	NV	N	RE PLG	SICS	+	+	-	-	+	PCIOL	2/60	20	3/60	18	6/60	14	6/36	14	6/24	12	6/12	12	N		
					LE	6/12	18	C	ND	RTL	PCIOL	3	0.3																								
43	BANUMATHY	59	F	179	RE	6/12	20	C	ND	RTL	IMC	3	0.3																								
					LE	HM	28	E	S	NRTL	MC	1 PAS	NV	N	LE PMG	COMB	+	+	-	-	-	PCIOL	1/60	18	3/60	18	5/60	18	6/60	16	6/36	16	6/36	16	N		
44	VINOLIYA	58	F	114	RE	6/24	18	C	ND	RTL	IMC	3	0.3																								
					LE	HM	30	E	ND C+F+	NRTL	HMC	NV	NV	N	LE PLG	SICS	+	+	+	-	-	PCIOL	4/60	16	6/60	16	6/36	14	6/24	14	6/24	14	6/18	14	N		
45	MANOGAR	56	M	1442	RE	PL	26	E	ND C+F+	NRTL	MC	NV	NV	N	RE PLG	SICS	+	+	-	-	-	PCIOL	3/60	12	3/60	12	4/60	12	6/60	12	6/36	12	6/36	12	N		
					LE	6/9	12	C	ND	RTL	PCIOL	3	0.3																								
46	MURAD	62	M	1705	RE	6/24	18	C	ND	RTL	PCIOL	3	0.3																								
					LE	PL	28	E	ND C+F+	NRTL	MC	NV	NV	N	LE PLG	SICS	+	+	-	-	-	PCIOL	1/60	18	1/60	16	3/60	16	5/60	14	6/60	14	6/36	14	N		
47	PUSHPA	53	F	1879	RE	PL	26	E	ND C+F+	NRTL	HMC	NV	NV	N	RE PLG	SICS	-	+	-	-	-	PCIOL	4/60	14	6/60	12	6/36	12	6/36	12	6/12	12	6/12	12	N		
					LE	6/9	16	C	ND	RTL	PCIOL	3	0.3																								
48	RAZAK	58	M	7890	RE	HM	32	E	S	NRTL	MC	1 PAS	NV	N	RE PMG	COMB	+	+	+	-	-	PCIOL	2/60	20	3/60	18	5/60	14	6/36	14	6/36	14	6/36	14	N		
					LE	6/18	20	C	ND	RTL	PCIOL	3	0.3																								
49	KANDASAMY	67	M	6790	RE	6/36	16	C	ND	RTL	IMC	3	0.4																								
					LE	PL	30	E	ND LP+	NRTL	HMC	NV	NV	N	LE LPG	SICS	+	+	-	-	-	PCIOL	5/60	16	6/60	16	6/36	16	6/24	14	6/12	14	6/				



