"COMPARATIVE STUDY BETWEEN PHACOCAPSULOTOMY AND NEEDLE ASPIRATION IN PHACOEMULSIFICATION OF WHITE INTUMESCENT CATARACT"

By

DR. DILIP KUMAR K

Dissertation Submitted to

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH

KOLAR

In partial fulfillment
Of the requirements for the degree of

MASTER OF SURGERY
IN
OPHTHALMOLOGY

Under the Guidance of
DR. NARENDRA P DATTI, M.S.

DEPARTMENT OF OPHTHALMOLOGY
SRI DEVARAJ URS MEDICAL COLLEGE
TAMAKA, KOLAR (APRIL - 2016)

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH

DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation entitled

"COMPARATIVE STUDY BETWEEN PHACOCAPSULOTOMY AND NEEDLE ASPIRATION IN PHACOEMULSIFICATION OF WHITE INTUMESCENT CATARACT"

is a bonafide and genuine research work carried out by me under the guidance of

DR. NARENDRA P DATTI, M.S.
Professor
Department of Ophthalmology
Sri Devaraj Urs Medical College
Kolar, Karnataka.

DATE: SIGNATURE OF THE CANDIDATE

PLACE: KOLAR **DR. DILIP KUMAR K**

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH

CERTIFICATE BY THE GUIDE

This is to certify that the dissertation entitled

"COMPARATIVE STUDY BETWEEN PHACOCAPSULOTOMY AND NEEDLE ASPIRATION IN PHACOEMULSIFICATION OF WHITE INTUMESCENT CATARACT"

is a bonafide research work done by

DR. DILIP KUMAR K

Under my guidance and supervision,
in partial fulfilment of the requirement for the degree of

M.S. IN OPHTHALMOLOGY.

DATE :

PLACE: KOLAR

SIGNATURE OF THE GUIDE

DR. NARENDRA P DATTI, *M.S.*
Professor
Department of Ophthalmology
S.D.U.M.C., Kolar.

ENDORSEMENT BY THE HOD, PRINCIPAL / HEAD OF THE INSTITUTION

This is to certify that the dissertation entitled

"COMPARATIVE STUDY BETWEEN PHACOCAPSULOTOMY AND NEEDLE ASPIRATION IN PHACOEMULSIFICATION OF WHITE INTUMESCENT CATARACT"

is a bonafide and genuine research work carried out by

DR. DILIP KUMAR K

under the guidance of

DR.NARENDRA P DATTI, M.S

Professor

Department of Ophthalmology

Sri Devaraj Urs Medical College

Signature of the HOD

Dr. K.KANTHAMANI, *M.S.*

Professor and H.O.D.

Department of Opthalmology

S.D.U.M.C., Tamaka, Kolar.

DATE :

PLACE : KOLAR

Signature of the Principal

Dr. B.G. RANGANATH, *M.D.*

Principal

Sri Devaraj Urs Medical College

Kolar, Karnataka

DATE:

PLACE : KOLAR

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION & RESEARCH

ETHICAL COMMITTEE CERTIFICATE

This is to certify, the ethical committee of
Sri Devaraj Urs Medical College, Tamaka, Kolar
has unanimously approved,

Dr. DILIP KUMAR K

Post Graduate student in the subject of Ophthalmology
at Sri Devaraj Urs Medical College, Kolar
to take up the dissertation work titled

"COMPARATIVE STUDY BETWEEN PHACOCAPSULOTOMY AND NEEDLE ASPIRATION IN PHACOEMULSIFICATION OF WHITE INTUMESCENT CATARACT"

to be submitted to Sri Devaraj Urs Academy of Higher Education and Research, Kolar, Karnataka

Signature of Member Secretary

Ethical committee

DATE:

PLACE: KOLAR

Signature and seal of the Principal

Dr. B.G.RANGANATH

Sri Devaraj Urs Medical College

Kolar, Karnataka

COPYRIGHT

DECLARATION BY THE CANDIDATE

I hereby declare that the Sri Devaraj Urs Academy of Higher Education and Research, Kolar shall have the rights to preserve, use and disseminate this dissertation in print or electronic format for academic / research purpose.

DATE:

PLACE: KOLAR

Signature of the Candidate

Dr. DILIP KUMAR K.
Post Graduate student
Department of Ophthalmology
Sri Devaraj Urs Medical College
Kolar, Karnataka

ACKNOWLEDGMENT

It is with great reverence, deep sense of gratitude and respect that I would like to thank my teacher and guide, ***DR.NARENDRA.P.DATTI,M.S,*** *Professor, Department of Ophthalmology, Sri Devaraj Urs Medical College Tamaka, Kolar for his guidance, encouragement, and valuable insights during the entire period of this study and post graduation course.*

I would like to express my appreciation and gratitude to ***Dr.K.KANTHAMANI*** *Professor and HOD, Department of Ophthalmology, Sri Devaraj Urs Medical College Tamaka, Kolar, for her encouragement and suggestions during the entire course of this study and post graduation course.*

I want to express my profound gratitude to ***Dr.D.KRISHNAMURTHY*** *&* ***DR.PADMAJOTHI,*** *my Professors, Department of Ophthalmology Sri Devaraj Urs Medical College Tamaka, Kolar whose knowledge and experience has guided me throughout my post graduation course.*

I would like to express my heartful thanks to my Assistant Professors, ***DR.RAJESHWARI, DR.NAGESHA****,* ***DR.USHA B.R, DR. RASHMI, DR. RANJITHA &*** *OT sister Miss* ***MARGARET,*** *Sri Devaraj Urs Medical College, Tamaka, Kolar for their help and encouragement rendered to me during this study.*

I am Immensely thankful to all my PG Colleagues especially ***DR.PREETI, DR.SUGARANJINI, DR.CHANDAN, DR.SNEHALATA,***

DR.JYOTSNA, DR.SHREY & DR.PREETHI *for their timely support and encouragement.*

My gratitude and thanks to ***DR.B.G.RANGANATH*** *M.D, (Community medicine), Principal, Sri Devaraj Urs Medical College Tamaka, Kolar , for letting me use the college and hospital facilities and resources.*

I would like to thank my parents ***SRI. KRISHNAN.P,*** *and* ***SMT. SHANTHKUMARI,*** *for having the confidence in me and standing by me in my difficult times . My special thanks to my brother* ***MANJUNATH*** *and sister* ***SUDHA*** *for their constant encouragement and help.*

My heartful gratitude to all my patients who submitted themselves most gracefully and whole heartedly participated in this study. I sincerely thank my institute Sri Devaraj Urs Medical College, Tamaka , Kolar for giving me a wonderful foundation and forum of knowledge in the field of Ophthalmology which stands for the rest of my life. Last, but not the least, I would like to express my gratitude to the ***almighty*** *for all his blessings .*

DATE: SIGNATURE OF THE CANDIDATE

PLACE: KOLAR

LIST OF ABBREVIATIONS USED

Sl.No.	ABBREVIATIONS	FULL FORM
1	AC	Anterior chamber
2	BCDV	Best corrected distance vision
3	CCC	Continuous curvilinear capsulorhexis
4	CF	Counting finger
5	D	Diopter
6	ECCE	Extracapsular cataract extraction
7	HM	Hand movements
8	ICCE	Intracapsular cataract extraction
9	IOL	Intraocular lens
10	IOP	Intraocular pressure
11	OVD	Ophthalmic viscosurgical device
12	PC	Posterior capsule
13	PCIOL	Posterior chamber intraocular lens
14	SICS	Small incision cataract surgery

ABSTRACT

TITLE OF THE TOPIC: "**COMPARATIVE STUDY BETWEEN PHACOCAPSULOTOMY AND NEEDLE ASPIRATION IN PHACOEMULSIFICATION OF WHITE INTUMESCENT CATARACT"**

NEED FOR THE STUDY:

Phacoemulsification has become the standard technique for cataract surgery. White intumescent cataract (swelling or hydration of lens associated with increased intralenticular pressure) represents a challenging situation for the surgeon. No step in contemporary cataract surgery is as important as the anterior capsulorhexis.[4] Upon puncturing the anterior capsule, there is rapid progression of uncontrollable tear towards lens periphery. To prevent this there are different methods. The standard technique is needle aspiration with the help of a 26-gauge needle, another new technique is phacocapsulotomy.

OBJECTIVES OF THE STUDY:

1) To study efficacy and safety between phacocapsulotomy and needle aspiration technique in white intumescent cataract in terms of intraoperative and postoperative complications.
2) To study postoperative visual outcome in phacocapsulotomy and needle aspiration inwhite intumescent cataract.

MATERIAL AND METHODS:

Source of Data:

Minimum of 100 patients diagnosed with white intumescent cataract will be selected for this prospective study at R.L.JALAPPA HOSPITAL AND RESEARCH

CENTRE, TAMAKA, KOLAR attached to SRI DEVARAJ URS MEDICAL COLLEGE between December 2013 and June 2015. Informed and written consent was taken from all the patients. After all necessary ocular and systemic examinations patients were divided into two groups of 50 each to undergo phacocapsulotomy and needle aspiration in facilitating CCC. Intraoperative complications and Post operative visual acuity was compared between two groups and complications if any was noted. Statistical analysis was done by Chi square tests and student t test.

RESULTS:

In our study we found that 1(2%) patient out of 50 patients who underwent phacocapsulotomy technique had radial extension of CCC compared to 8(16%) out of 50 patients in needle aspiration group which was statistically significant (p=0.04) and also there was decrease in intralenticular pressure noted in 44(88%) in phacocapsulotomy group and 26(52%) in needle aspiration group which was statistically significant (p value=0.03).

CONCLUSION:

We found that, phacocapsulotomy technique is a simple, controlled and effective technique that extends the possibility of routinely achieving a CCC and thus prevent radial extension of CCC. It also allows for safe phacoemulsification and well centered in the bag IOL implantation.

KEYWORDS

Phacoemulsification, Intumescent cataract, phacocapsulotomy & needle aspiration.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF GRAPHS

LIST OF PHOTOGRAPHS

INTRODUCTION

Cataract, as the leading cause of blindness and visual impairment, is responsible for 50% of blindness worldwide.[1] The prevalence of cataract in different populations has been reported between 2.0% and 65%.[2]In India, there are 12.5 million blind and it is estimated that 50% to 80%[3] of them are blind due to cataract.

Phacoemulsification has become the standard technique for cataract surgery. White intumescent cataract (swelling or hydration of lens associated with increased intralenticular pressure) represents a challenging situation for the surgeon. No step in contemporary cataract surgery is as important as the anterior capsulorhexis.[4] A strong, intact capsulorhexis is crucial to safe and successful phacoemulsification.[4]

Anterior continuous curvilinear capsulorhexis can be difficult to perform in eyes with intumescent cataract because of compromised red reflex and high intralenticular pressure. Upon puncturing the anterior capsule, there is rapid progression of uncontrollable tear towards lens periphery.[4]When this occurs, the appearance of the stained blue anterior capsule beside the white cataract mimics the blue-white-blue pattern of the Argentinian flag and was named Argentinian flag sign.[5] Once this occurs, the remainder of cataract extraction can become extremely difficult and can lead to many complications, such as posterior capsule rupture, vitreous loss, retained nucleus and endothelial damage due to prolonged surgical time.

To prevent this there are different methods. The standard technique is needle aspiration with the help of a 26-gauge needle which is introduced into an intact anterior capsule followed by injection of OVD.[6]

The other new technique is phacocapsulotomy where the phacoemulsification tip is introduced through the centre of anterior capsule and portion of the lens is aspirated (this simultaneously creates the initial anterior capsule puncture and removes some of the liquefied cortex and nucleus).[5]

Multiple studies demonstrate how to do phacocapsulotomy technique, but there are no studies which compare it with other techniques. Hence we intend to conduct this study to know the efficacy and safety of phacocapsulotomy in comparison with needle aspiration technique in white intumescent cataract.

OBJECTIVES OF STUDY

1) To study efficacy and safety between phacocapsulotomy and needle aspiration technique in white intumescent cataract in terms of intraoperative and postoperative complications.

2) To study postoperative visual outcomein phacocapsulotomy and needle aspiration inwhite intumescent cataract.

REVIEW OF LITERATURE

DEVELOPMENT OF THE LENS

The rudimentary lens is first seen as a thickening of the surface ectoderm, the lens placode at 22 days gestation; it overlies the optic vesicle. The lens placode forms the lens vesicle which consists of a single layer of cells. The cells forming the posterior wall of the lens rapidly elongate and become filled with proteins called crystallins. These densely packed elongated cells are known as the primary lens fibres. Additional fibres are formed by the mitotic division of the anterior epithelial cells at the equator known as secondary lens fibres. New secondary lens fibres are formed throughout life and persist throughout life. The end of the fibres come into apposition at sites referred to as sutures.

In the foetus, the lens grows rapidly, because it is supplied by the hyaloid artery, which forms a plexus on the posterior surface of the lens. The vascular lens capsule is formed from the mesenchyme. The true lens capsule is formed from the thickened basal lamina.[7]

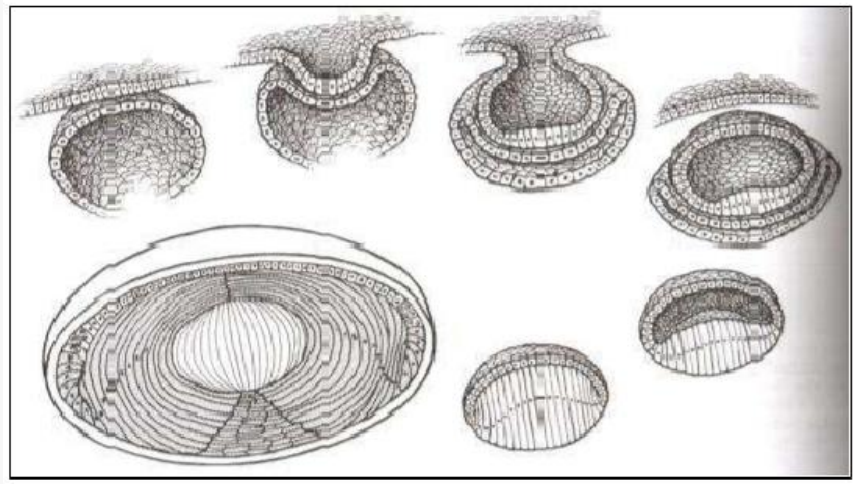


Figure 1: Development of lens

ANATOMY OF THE LENS

The lens is a transparent, biconvex, elliptical, semisolid, avascular body of crystalline appearance, enclosed in its capsule, situated immediately behind the iris and in front of the vitreous body in a saucer shaped depression called *patellar fossa*.It does not possess nerves, blood vessels or connective tissue.[8,9] It is encircled by the ciliary processes, which slightly overlap its margin.

In the adult, the lens measures approximately 9-10 mm in diameter and 3-4 mm in thickness. The rim of the lens separating the anterior and posterior surfaces is called *equator*. Centre of anterior surface is known as the *anterior pole* and centre of the posterior surface is known as the *posterior pole.*

The equator of the lens forms a circle lying 0.5mm within the ciliary processes. The equator is not smooth but shows a number of dentations, which corresponds to the attachment of the zonular fibres. These dentations disappear when the zonules are loose during accommodation.[10]

The refractive index of the lens is 1.39. The dioptric contribution of the lens is about 15, out of a total of about 55 diopters (D) for the normal eye. Its accommodative power varies with age, being 14-16 D at birth; 7-8 D at 25 years of age and 1-2 D at 50 years of age.

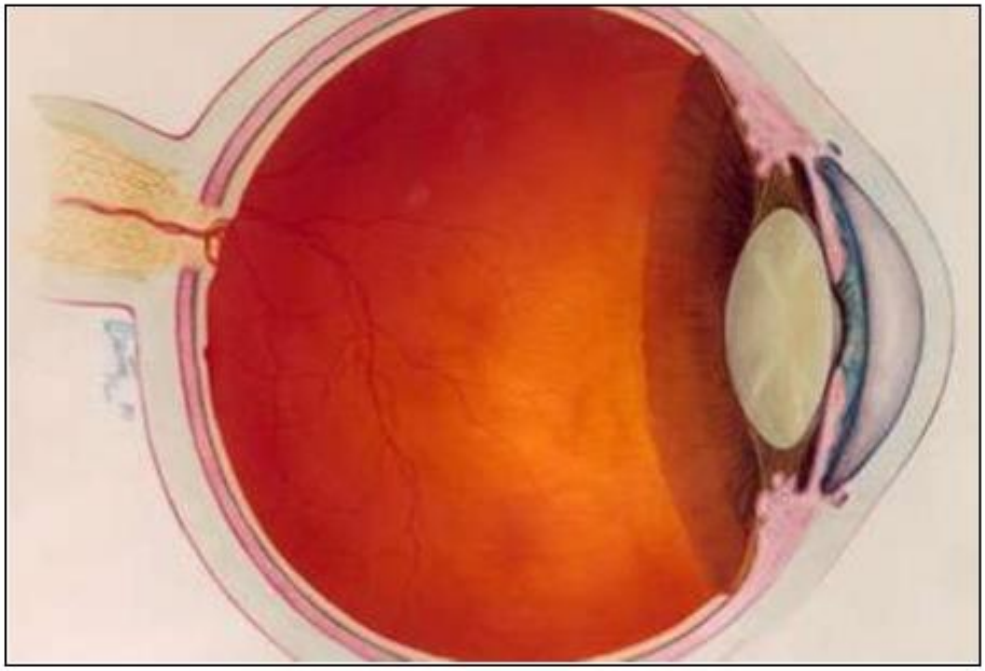


Figure 2: Position of the lens in the eye.

STRUCTURE OF THE LENS

1. **Lens Capsule** - It is a thin, homogenous, transparent, highly elastic and hyaline collagenous membrane which closely surrounds the lens. It is secreted at the embryonic stage as a basement membrane of lens epithelium (thickest basement membrane of the body). It is thicker anteriorly and at the equators than posteriorly. The thickness of the capsule is 2.8 micron at the posterior pole, which is the thinnest part of the capsule and at anterior pole is 15.5 µm. Unlike the anterior capsule, the posterior capsule does not thicken with age; however, it has a tensile strength that is greater than that of anterior capsule. Under polarized light, it is birefringent, indicating a lamellar structure with fibres arranged parallel to its surface. The capsule is produced anteriorly by the lens epithelium and posteriorly by the elongating fibre cells. The elastic capsule can be

stretched to 60% of its circumference without tearing. It serves as a diffusion barrier and is freely permeable to low molecular weight compounds but restricts the movement of large colloidal particles.

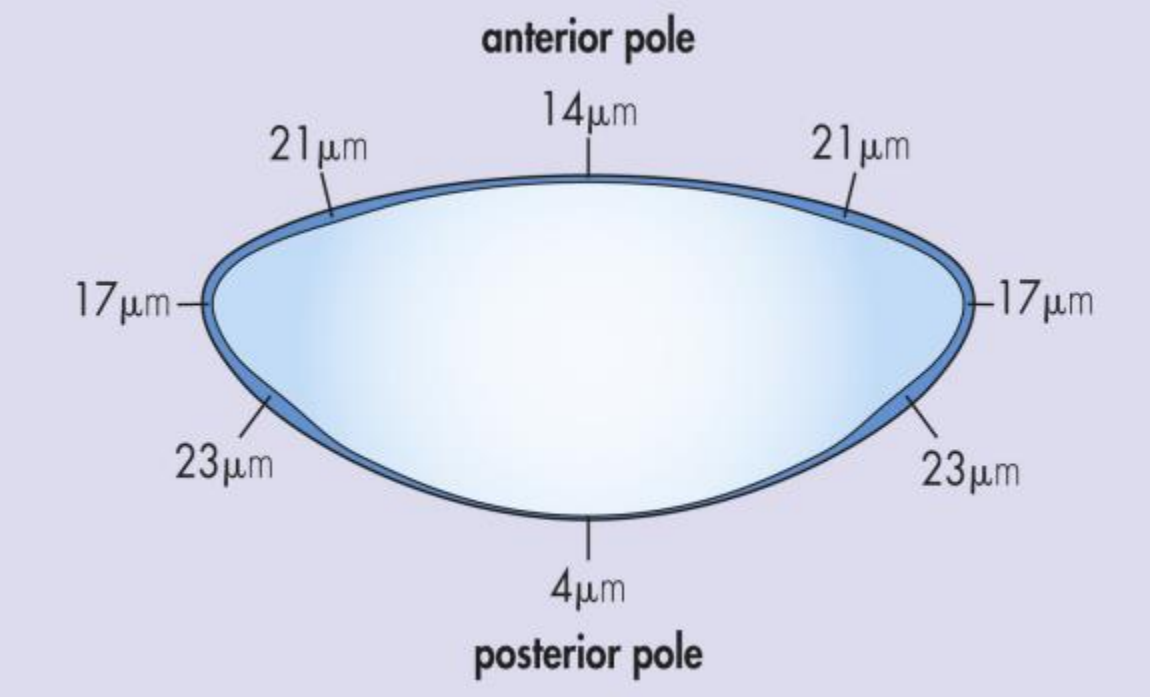


Figure 3: Thickness of lens capsule.

2. **Lens Epithelium**: Anterior lens epithelium is a single layer of cuboidal nucleated epithelial cells which lies deep to the anterior capsule. Almost all the metabolic, synthetic and transport processes of lens occur in this layer. In *equatorial region*, cells become *columnar* and actively divide and elongate to form new lens fibres throughout life. There is no posterior epithelium, as these cells are used up in filling the central cavity of the lens vesicle during development of the lens.

The anterior lens epithelium is divided into 3 zones.

a. **Central zone**: consists of cuboidal cells, which are polygonal in flat section. It represents stable population of cells.

b. **Intermediate zone**: comparatively smaller and more cylindrical cells, located peripheral to central zone.

c. **Germinative zone**: columnar cells, most peripheral fibres and located just pre-equatorial. These cells actively divide to form the new cells which migrate posteriorly to form new lens fibres.

The lens epithelium has two different types of cells:

1. *A-cells* are located in the anterior central zone (corresponding to the central zone of anterior lens capsule). They consist of relatively quiescent epithelial cells with minimal mitotic activity. However in inflammation or trauma, an anterior sub-capsular epithelial plaque may form.

2. *E-cells* are located in the second zone, as a continuation of the anterior lens epithelial cells around the equator, forming the equatorial lens bow, with the germinal cells. These cells normally show mitotic capability, and new lens fibres are continuously produced at this site. E-cells are responsible for continuous growth in size and weight of the lens throughout life. In pathological states, the E cells tend to migrate posteriorly along the posterior capsule and are the primary source of classic secondary cataract.

3. **Lens Substance:** This is the intracellular amorphous substance in the lens. The adult lens substance consists of the nucleus and the cortex. Although the size of these two regions is age

dependent, studies of lenses with an average age of 61 years indicate that the nucleus accounts for approximately 84% of the diameter and thickness and cortex for the remaining 16%. The nucleus is further subdivided into embryonic, foetal, infantile and adult nuclei. The embryonic nucleus contains the original primary lens fibre cells.

4. **Lens Fibres**: Lens fibres are elongated, prismatic bands. They are formed constantly throughout life by the elongation of lens epithelial cells at the equator. As the lens fibres elongate and new ones are form, the older ones are pushed towards the depth of the lens. Ninety percent of the mass of the lens fibres consists of proteins called crystallins.

The consistency of the lens varies; the superficial cortex is softer than the central part of the nucleus. The colour of the lens also changes with age. In the infant and young, it is quite colourless. After about 35 years the central portion develops a yellow tinge and gradually becomes darker and more extensive with age. In older persons the lens is amber coloured.

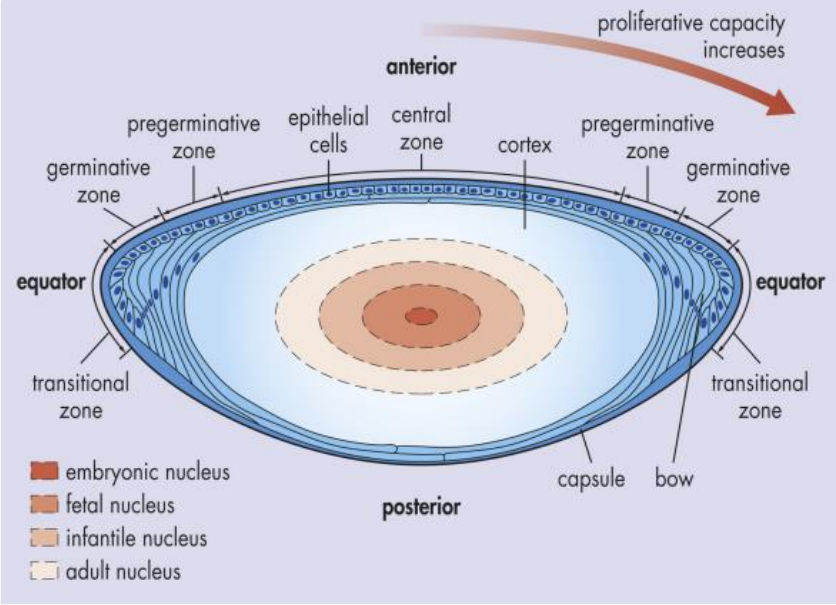


Figure 4: Gross anatomy of lens.

The term cataract was introduced by **ConstantinusAfricanus** (AD 1018) as "cataracta" meaning to rush down, as a waterfall or portcullis.FrenchsurgeonPierre **Brisseau** in 1705 was the first to describe cataract as a clouding of the lens.[11]

It is defined as any opacity in the crystalline lens or its capsule which obstructs or distorts light entering into the eye. According to some authors, cataract is a structural, physical, bio-chemical and optical change in the crystalline lens of the eye that interferes with the normal transmission and refraction of light rays. This interference affects the overall sharpness of definition of the retinal image.

Cataract is the chief cause of avoidable blindness in India and throughout the world. There are an estimated 9-12 million blind in India, half of which can be attributed to cataract. It is estimated that another three million develop visually disabling cataracts each year. [12]

CLASSIFICATION OF CATARACT

A) ETIOLOGICAL CLASSIFICATION

I) Congenital and Developmental Cataract

II) Acquired Cataract

1. Senile Cataract

2. Traumatic Cataract

3. Complicated Cataract

4. Metabolic Cataract

5. Electric Cataract

6. Radiation Cataract

7. Toxic Cataract

i. Corticosteroid induced

ii. Miotics induced

iii. Copper (Chalcosis) and Iron (Siderosis) induced

8. Dermatogenic Cataract

9. Cataract associated with osseous diseases

10. Cataract with miscellaneous syndromes

i. Dystrophicamyotonica

ii. Down's syndrome

B) MORPHOLOGICAL CLASSIFICATION:-

1. Capsular Cataract

i. Anterior capsular

ii. Posterior capsular

2. Sub-capsular Cataract

i. Anterior sub-capsular

ii. Posterior sub-capsular

3. Cortical Cataract

4. Supra-nuclear Cataract

5. Nuclear Cataract

6. Polar Cataract

i) Anterior polar

ii) Posterior polar

STAGES OF MATURATION

[A] Maturation of the cortical type of senilecataract

1. ***Stage of lamellar separation:*** The earliest senilechange is demarcation of cortical fibres owing to theirseparation by fluid. This phenomenon of lamellarseparation can be demonstrated by slit-lampexamination only. These changes are reversible.

2. ***Stage of incipient cataract:***In this stage earlydetectable opacities with clear areas between themare seen. Two distinct types of senile corticalcataracts can be recognized at this stage: (a).Cuneiform senile cortical cataract. It ischaracterized by wedge-shaped opacities with clear areas in between. These extend from equator towardscentre and in early stages can only be demonstratedafter dilatation of the pupil. They are first seen in thelower nasal quadrant. These opacities are presentboth in anterior and posterior cortex and their apicesslowly progress towards the pupil. On obliqueillumination these present a typical radial spoke-likepattern of greyish white opacities . On distantdirect ophthalmoscopy, these opacities appear as darklines against the red fundal glow.Since the cuneiform cataract starts at periphery and extends centrally, the visual disturbances arenoted at a comparatively late stage. (b) Cupuliform senile cortical cataract. Here a saucershaped opacity develops just below the capsuleusually in the central part of posterior cortex (posteriorsubcapsular cataract), which gradually extendsoutwards. There is usually a definite demarcationbetween the cataract and the surrounding clear cortex.Cupuliform cataract lies right in the pathway of theaxial rays and thus causes an early loss of visualacuity.

3. ***Immature senile cataract (ISC):*** In this stage,opacification progresses further. The cuneiform orcupuliform patterns can be recognized till theadvanced stage of ISC when opacification becomesmore diffuse and irregular. The lens appears grayish white but clear cortex is still present and soiris shadow is visible.In some patients, at this stage, lens may becomeswollen due to continued hydration. This conditionis called ***'INTUMESCENT CATARACT'.*** Intumescence maypersist even in the next stage of maturation. Due toswollen lens, anterior chamber becomes shallow.

Figure 5: Intumescent cataract

4. ***Mature senile cataract (MSC):*** In this stage,opacification becomes complete, i.e., whole of the cortex is involved. Lens becomes pearly white incolour. Such a cataract is also labelled as'ripecataract'.

5. ***Hypermature senile cataract (HMSC):***When themature cataract is left in situ, the stage of hypermaturity sets in. The hypermature cataract mayoccur in any of the two forms: (a) Morgagnianhypermature cataract: In somepatients, after maturity the whole cortex liquefiesand the lens is converted into a bag of milkyfluid. The small brownish nucleus settles at the

bottom, altering its position with change in theposition of the head. Such a cataract is called Morgagnian cataract. Sometimes inthis stage, calcium deposits may also be seen on the lens capsule.

(b) Sclerotic type hypermature cataract:Sometimes after the stage of maturity, the cortexbecomes disintegrated and the lens becomesshrunken due to leakage of water. The anterior

capsule is wrinkled and thickened due toproliferation of anterior cells and a dense white capsular cataract may be formed in the pupillary area. Due to shrinkage of lens, anterior chamberbecomes deep and iris becomes tremulous(iridodonesis).

[B] Maturation of nuclear senile cataract

In it, the sclerotic process renders the lens inelasticand hard, decreases its ability to accommodate andobstructs the light rays. These changes begincentrally and slowly spread peripherallyalmost up to the capsule when it becomes mature;however, a very thin layer of clear cortex may remainunaffected.The nucleus may become diffusely cloudy(greyish) or tinted (yellow to black) due to depositionof pigments. In practice, the commonly observed pigmented nuclear cataracts are either amber, brown(cataractabrunescens) or black (cataractanigra)and rarely reddish (cataractarubra) in colour.

Cataract surgery is one of the oldest surgical procedures known, first documented in the fifth century BC, introduced to Europe from India by the armies of Alexander the Great. It is now the most frequently performed surgical procedure in the Western world.[13]

Prior to 1750 AD, cataract was treated by dislocation into the vitreous cavity using a lance, a process known as couching. The earliest reference to couching was found in Sanskrit manuscripts dating from the 5th century BC written by **Sushruta,** an Indian surgeon. This technique could only be performed when the lens had become completely opaque, rigid, and heavy to the point that the supporting zonules had become fragile. The eye would then be struck with a blunt object with sufficient force to cause the zonules to break so that the lens would dislocate into the vitreous cavity, restoring limited but completely unfocussed vision.

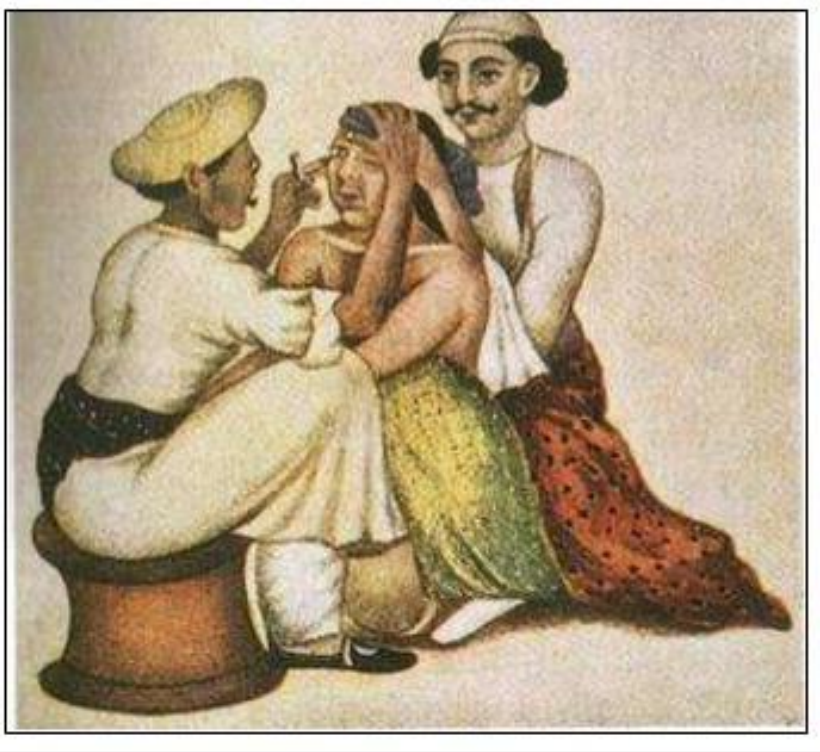


Figure 6: Couching

The first description of the cataract and its treatment in the West appeared in 29 AD in De Medicina, the work of the Latin encyclopaedist**Celsus**, which noted the practice of needling, technique that breaks up the cataract into smaller particles, thereby facilitating their absorption.

Progress in cataract surgery required a modern understanding of light which came through the work of Newton, Dalton and Young, as well as a modern understanding of the anatomy and pathology of the eye. **Jacques Daviel** described the first planned surgical extraction of cataract in 1748. **Samuel Sharp** of London introduced the concept of intra-capsular cataract surgery in 1753 by using pressure with his thumb to remove the entire lens intact through an incision.

Albrecht von Graefe (1828-1870), in Germany, established the benefit of a small linear scleral incision for extra-capsular surgery rather than a large limbal corneal incision. The use of sutures for cataract surgery was first described by **Henry Willard Williams** of Boston in 1867. **Koller** in 1884 introduced anaesthesia in the form of eye-drops (cocaine), obviating the hazards of general anaesthesia and its postoperative complications.

Stanculeanu (1912), **Knapp** (1914), **Anton** (1922), **Sinclair** (1925) developed the techniques of intra-capsular operation using various patterns of capsule forceps. Cryosurgery was introduced by **Krawitz**of Poland in 1961 to remove the lens with a tiny probe that could attach by freezing a small area on the surface of the lens.

The operating microscope was first used for eye surgery by **Ken Swann** in Portland, Oregon, in 1948. This began the era of ophthalmic microsurgery. This was closely followed by another important watershed, the invention of the intraocular lens (IOL). **Harold Ridley** implanted the first IOL in 1948.

In 1967, **Charles Kelman** introduced phacoemulsification, a technique that uses ultrasonic waves to emulsify the nucleus of the crystalline lens in order to remove the cataract without a large incision.

Richard Kratz developed the scleral pocket incision. The incision consisted of a posteriorly placed incision with a scleral tunnel and a corneal wedge. However, these incisions had to be

closed with sutures. **Michael McFarland** in 1990 demonstrated the first suture-less closure of scleral tunnel wound. **Fine** in 1992 described a new concept of a planar temporal clear corneal suture less incision.

Phakonit is the latest technique of phacoemulsification first devised by **Amar Agarwal** (India). The advantage of Phakonit over conventional phacoemulsification is that here the size of incision is below 1mm.

Laser cataract surgery is a technique similar as phacoemulsification procedure. In this cataract surgery instead of ultrasound power, laser energy is used. Image-guided laser cataract surgery was first conceptualized by **D. Palanker** and **M. Blumenkranz** in 2005. The femtosecond laser procedure was used clinically in cataract surgery by Professor **Zoltan Nagy** in Budapest, Hungary in 2008.

The different methods of cataract surgery are:

1. Conventional intra-capsular cataract extraction.
2. Extra-capsular cataract extraction.

INTRA-CAPSULAR CATARACT EXTRACTION (ICCE):

a) Cryoextraction

b) Capsule forceps extraction

c) Erysiphake extraction

EXTRA-CAPSULAR CATARACT EXTRACTION (ECCE):

a) Conventional ECCE

b) ECCE by manual small incision cataract surgery (MSICS) or small incision manual nucleus fragmentation.

c) Phacoemulsification.

PHACOEMULSIFICATION

Phacoemulsification is the preferred technique for cataract surgery in developed countries, and also to some extent in the developing countries. Basic steps in phacoemulsification are:

1. Incision.
2. Entry.
3. Capsulorhexis.
4. Hydrodissection.
5. Hydrodelineation.
6. Nucleus emulsification.
7. Cortical wash.
8. IOL implantation.
9. Wound closure.

A critical step in ECCE (either ECCE by Phacoemulsificationor the conventional ECCE) is making a window in anteriorcapsule wall (i.e. anterior capsulotomy). Techniquesemployed for this task have undergone sustained evolution. The primitive technique forcapsulotomy was Vogt's technique.[14] He utilized toothed forceps for grasping and rippingout a part of anterior capsule. This could often lead to unpredictableand even catastrophic outcomes.[15]In 1968 Kelmanintroduced ''Christmas tree'' approach in which a dull cystitomewas used to peel

anterior capsule cortex and tore thatin triangular or Christmas tree morphology instead of cuttingthe cortex.[16] These techniques werelargely replaced by the following techniques.

1. Multipuncture (Can opener) capsulotomy.
2. Continuous curvilinear capsulotomy (Capsulorhexis).
3. Envelope (Intercapsular) capsulotomy.

A. MULTIPUNCTURE (CAN-OPENER) CAPSULOTOMY[17-22]

This style of anterior capsulotomy has derived its name from the circular nibbling opening of the capsule through the use of a cystotome. There have been many modifications and variations in the technique. The classical can-opener capsulotomy creates a ragged but approximately circular opening.Multipuncture 'postal stamp' capsulotomy involves multiple punctures made in a circular fashion.

TECHNIQUE

A circular opening of approximately 5 to 6 mm in diameter may be created with the cystotome created by bending a 26-gauge or finer needle, or from innumerable other customized styles. Multiple punctures, like 12-15 are made per quadrant. The entire procedure may be performed in a closed chamber with the cystotome entering unopened anterior chamber, completely open or semi closed chamber. Irrigating cystotome, air bubble, or viscoelastic material may be used to maintain anterior chamber.

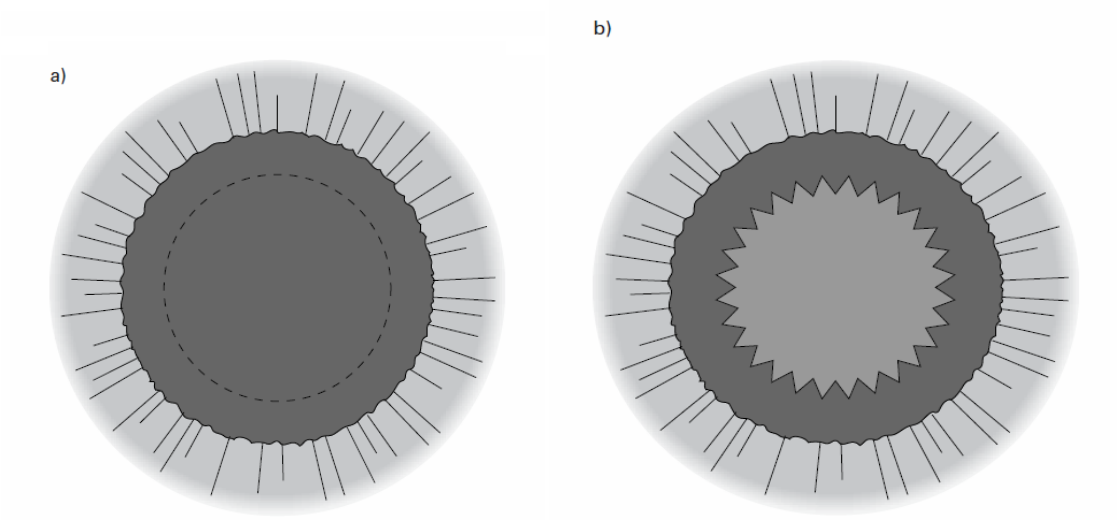


Figure 7: Can-opener Capsulotomy.

ADVANTAGES:

1. Easy to learn and is therefore practiced widely.
2. It can be performed on all types of cataracts including intumescent and hypermature cataracts.
3. Consistent desired diameter.
4. Easier to use in small pupil cases.
5. Removal of 12 o' clock cortex is easier.

DISADVANTAGES:

1. Radial Anterior Capsular Tears.
2. High zonule stress during procedure.
3. Skip areas with incomplete capsulotomy.
4. Capsular tags may occlude I/A port during cortex removal and also cause posterior capsule rupture.
5. Poor support for PCIOL implantation if posterior capsule broken.

B. CONTINUOUS CURVILINEAR CAPSULOTOMY (CAPSULORHEXIS)[23-29]

Capsulorhexis is not just a neat way to open theanterior capsule. It is fundamentally different fromall previous techniques in that it maintains themechanical and structural integrity of the capsularbag. It has therefore become the universallyaccepted standard method of opening the anteriorcapsule for the purpose of cataract extraction.The continuous smooth edge to thecapsulotomy provides a much greater degree ofstrength, and as such it has contributedsignificantly to the development of today's safeand controllable phacoemulsification techniques.Moreover, it has made possible precise,reproducible, and permanent intracapsularfixation of the intraocular lens (IOL).

In 1984,simultaneously and independently, HowardGimbel and Thomas Neuhann described thesame technique, namely tearing a circularopening in the anterior capsule, instead ofcutting or ripping the capsule, to obtain anaperture with a smooth continuous margin. Thetechnique was demonstrated in 1985 in the formof video presentations, and the first formalpublication was in 1987. The new term"capsulorhexis" (capsule tearing) was proposedby Thomas Neuhann in order to emphasize thenovel nature of the technique. Howard Gimbeloriginally termed his technique "continuous tearcapsulotomy". By bringing together both terms,the abbreviation "CCC" for "continuouscurvilinear capsulorhexis" evolved.

PHYSICS OF CAPSULORRHEXIS

Types of force

1. **Tearing:** Using a ripping motion, the tear obtained will beuncontrolled. Since many fibres are pulled, all at different anglesand with differing force, the break-point will not be simultaneous and thus the tear will be uncontrolled.

2. **Shearing:** In this, one fibre is broken at a time. Thus the tear ismore controlled and requires much less force.

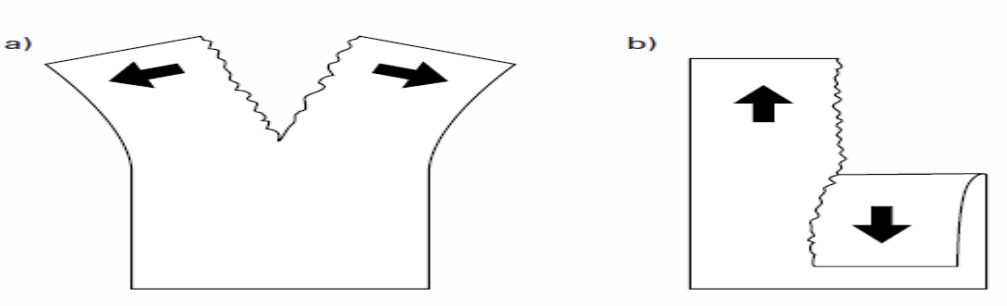


Figure 8: Physics of CCC a) Tearing by stretching, b) Tearing by shearing

Tangential force

A line perpendicular to the radiusat any point on a circle is thetangent at that point. Any forceapplied in this direction isTangential Force.The directionof tangential force is continuouslychanging. Movement of the needleshould be curvilinear along theproposed margin of CCC (nearlysuper-imposing).

Figure 9: Tangential force of CCC

SIZE OF CCC

The CCC should be 5.5 to 6mm or cover the opticof the IOL by 0.25 mm circumferentially.

There are three basic choices a surgeon has tomake at the outset:

• The instrument used: a cystotome needle orcapsulorhexis forceps.

• The access: via the main incision or via a sideport (paracentesis).

• The medium: irrigation with fluid, viscoelastic,or air.

PRE-REQUISITES

The pre-requisites for a good CCC are:

1. Good akinesia

2. Moderate hypotony: For phacoemulsification, moderate to minimalhypotony is required. The eye should not be very soft (as requiredfor ECCE) since nucleotomy becomes difficult.

3. Good red reflex: Following measures should be taken for a goodred reflex:

- The lipid layer of the tear film is removed by scrubbing with abetadine-soaked swabstick and washing with BSS simultaneously.
- Position the eyeball and head in such a way so as to obtain a good red reflex.
- The pupil should be well dilated with mydriatic.

TECHNIQUES OF CCC[30-32]

CCC can be done either with bent 26 gauge needle or forceps or a combination of the two. The aqueous in AC should be totally replaced with viscoelastictill the lens-iris diaphragm moves backwards and the chamber is flat/concave in centre. Approximate IOP should be 25-30 mmHg.Underno circumstances should rhexis be done in a shallow AC with aconvex lens-iris diaphragm.

NEEDLE CCC

Rhexis can be done from the main port or side port. Advantage of side port rhexis is that there is no leakage of viscoelastic, but there is lessmaneuverability. Rhexis from main port obviously means bettermaneuverability, but there is more leakage and one needs to keep reforming the chamber.

Figure 10: A Cystitome

A. Initiation of CCC

The cystitome is mounted on a viscoelastic filled syringe.

i)Linear cut

The needle is kept vertical at theexact centre of the pupil. Press itgently downwards to perforatethe capsule. Move in a linearfashion towards the right creatinga cut of approximately 1.5 mmin length. Linear extension canalso be done by multiplepunctures as in 'can openertechnique' from uncut to cut area.

ii) Raising the flap

The needle is then brought to thejunction of medial 2/3rd andlateral 1/3rd of the cut. Put theneedle under the cut edge and tryto lift the cut edge ***up towards***the ceiling. Snap open the

flap.The initial force will be directedtowards the ceiling and as soonas you get the feeling of give-waythen turn it down, giving a curvilinearextension of approximately1 mm. Now the cut end isapproximately 2.5 mm from thecentre and if the rhexis is continuedparallel to the pupillary border, it will be 5 mm indiameter.

B. **Continuation of CCC**

The flap is turned over such that the anterior surface of the flap istouching the intact capsule. This can be achieved by either pushing itover with the cystitome or using OVD, or a combination of both. At thispoint, it is to be emphasized that you need to have a mental picture ofyour proposed CCC with relation to the pupillary border beforeprogressing.The needle is kept on the line of proposed CCC approximately 1mm away from the cut end, for good control. To initiate the movement,the flap is gradually stretched such that there is a tactile feed backbefore it gives way and tears. If the needle is too close to the cut end, ittears too soon and you are not able to maintain control. If you keep toofar away, applying a tangential force is difficult and you lose controlof the direction. Normally in one push, you can achieve 1–3 clockhours of CCC. The flap should be flat without any wrinkles. The needle should be kept lightly on the flap.As in driving, you watch the road and not the steering wheel,similarly, after positioning the needle, concentrate on the movement ofthe advancing end of the CCC and do not look at the needle.

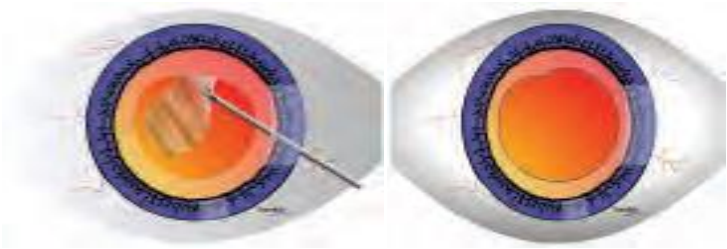


Figure 11: Technique of CCC

FORCEPS CCC

Forceps of theUtrata type require access throughthe main incision (approximately 3 mm in width)whereas vitrectomy-type forceps,such as the Koch forceps, may be used througha paracentesis. To commence the forcepstechnique a small central puncture is first madein the anterior capsule, either with a needle or tipof the forceps. Some forceps are available withsharpened tips that are specifically designed for this purpose. Capsulorhexis using forceps allows thecapsule to be grasped directly and has theadvantage of making the technique morecontrollable for many surgeons.

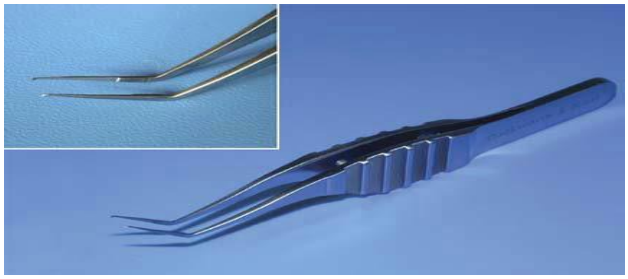


Figure 12: Utrata forceps

Advantages of Forceps:

- Grip on the flap is very good and no counter pressure is required.
- It is easier to change the direction of the flap.

- Particularly useful in fibrotic, atrophic and elastic (i.e. pediatric) capsules and in soft cataractwith high intra-lenticular pressure (morgagnian and intumescent) where one is not able to get a good counter pressure.
- Posterior CCC and pediatric cataracts are not possible with cystitome and require use offorceps.

Disadvantages of Forceps:

- Wound leak and distortion of the cornea.
- It is particularly difficult to use if you are using low viscosity viscoelastic, e.g. methylcellulose.
- When initiating the CCC, the puncture may not be as comfortable with the forceps so it is better to initiate with the needle and then continue with forceps.

DIFFICULT SITUATIONS IN CAPSULORHEXIS:

The following four basic types of difficulties present challenges for capsulorrhexis:

1. No red reflex.
2. Small pupil.
3. Positive back pressure.
4. Extreme elasticity of capsule.

ADVANTAGES OF CAPSULORHEXIS:

1. In situ phacoemulsification is facilitated, and ultrasonic turbulence is contained with in the lens capsule.
2. IOL implantation and verification in the bag is greatly facilitated because of smooth edged visible rim.
3. IOL rotation with no chance of decentration caused by loops coming out of the bag is allowed.
4. No capsular tags or V shaped tears are left that can extend into the posterior capsule, under even minimal mechanical stress.
5. A diaphragm quality of the capsule for sulcus placed lenses is maintained or preserved in the event of a ruptured posterior capsule.
6. Chances of posterior synechiae are reduced.
7. In the bag IOL implantation in the very elastic capsule of children is facilitated.

DISADVANTAGES OF CAPSULORHEXIS:

1. Limits nuclear prolapse; ECCE more difficult.
2. Limits access to superior nucleus during phacoemulsification.
3. More difficult to learn.
4. Tendency towards smaller diameter.
5. Capsular bag distension syndrome.

C. ENVELOPE (INTERCAPSULAR) CAPSULOTOMY

In 1979, Sourdilla and Baikuff in France suggested this approach. However Galand developed it to its present stage and popularized the 'Envelope Technique'.

TECHNIQUE

A horizontal, slightly curved linear capsulotomy is aimed at the junction of upper 1/3rd to middle. The punctures are directed slightly superiorly as the capsulotomy approaches the right hand side. This keeps the superior flap slightly more mobile and gives a better access to the superior capsular fornix for the removal of cortical matter. This is also known as antismilingcapsulotomy which gives an excellent entry into the capsular bag. Therefore, placement of the implant in the bag is easier.

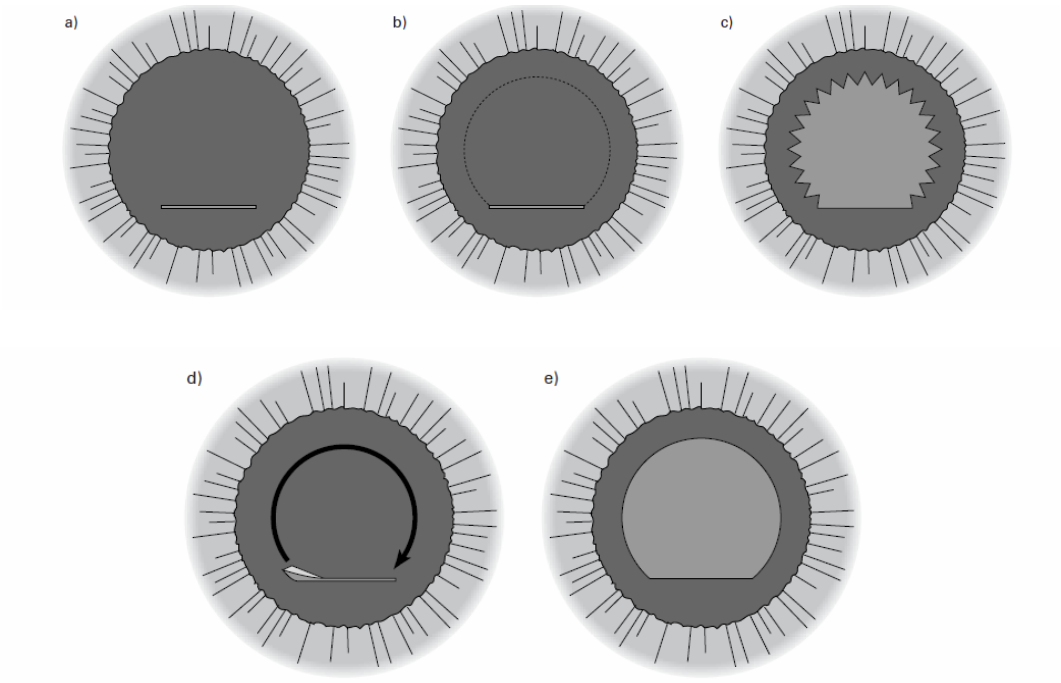


Figure 13: Envelope capsulotomy

ADVANTAGES:

1. The presence of anterior capsule until the IOL is implanted reduces the trauma to the tissue.
2. The preservation of anterior capsule creates a semiclosed system within the anterior chamber and therefore, facilitates removal of cortical material.
3. Scraping of the anterior capsule to remove epithelial cells is also possible.
4. In the event of a posterior capsule rupture, anterior capsule may be utilized for an IOL support.

DISADVANTAGES:

1. It produces marked asymmetry of the capsular flaps. This predisposes to decentration of an IOL.
2. The Intraocular lens tends to decentre upwards.
3. Radial anterior capsular tears
4. In-the-bag placement becomes uncertain because of these tears.
5. The free floating capsular tears can get stuck to the pupillary margin and produce a distorted pupil later on.

WHITE INTUMESCENT CATARACT

A white cataract can be defined as totally opacified lens matter precluding visualization of red reflex, regardless of its etiology. White cataracts are classified as intumescent, mature or hypermature based on the depth of the anterior capsule and nature of lens matter. White intumescent cataract is a swollen hydrated lens with shallow anterior chamber and associated high intralenticular pressure. A cataract with totally opaque lens matter in presence of normal anterior chamber depth and normal intralenticular pressure is considered mature. A hypermature cataract is characterized by fibrosed anterior capsule, a liquefied milky lens, or both.

PATHOPHYSIOLOGY

As the cataract matures, the lens fibers degenerate, leaving cytoplasmic protein globules between the fibers of the cortical lamellae. Increasing amounts of cortex degenerate with time and the globules begin to coalesce creating large accumulations of liquefied lens protein. Because of the increased concentration of protein molecules under the lens capsule, water is drawn from the

aqueous into the lens capsule via osmosis. This may result in a swollen, tense lens capsule and increased intralenticular pressure. Some cases of intumescent cataract are due to physical damageto the capsule. A frank traumatic break in the capsule will resultin rapid hydration and opacification of the cortex.

CLINICAL FEATURE

- Diminution of vision- Hand movements to perception of light.
- Shallow anterior chamber.
- White swollen lens with increased concavity of anterior surface.
- Dense postinflammatory plaques in post traumatic.
- Raised intraocular pressure, if secondary glaucoma sets in.

COMPLICATION

- Phacomorphic glaucoma:

  The mechanism involves anterior displacement of the lens–iris diaphragm by the swollen cataractous lens with pretrabecular occlusion to aqueous outflow by the peripheral iris.[33] In addition to peripheral occlusion of the iridocorneal angle due to an anterior pushing force from the intumescent lens, there is usually a component of pupillary block in phacomorphic glaucoma. The inability of aqueous to flow through the pupil and into the anterior chamber results in a positive pressure gradient between the posterior and anterior chamber leading to iris bombé and further closure of the iridocorneal angle.

PROBLEMS FACED DURING SURGERY

Surgical removal of an intumescent lens presents several special challenges to the surgeon. An intumescent lens is a lens that has begun to lose structural integrity; the protein is denatured to the point that the lens is becoming hydrating. The problems are due to:

1. The red reflex is absent.
2. High intralenticular pressure.
3. The capsule is thinner and more fragile.
4. Zonules may be weakened or absent.
5. The nucleus is often large and hard if the intumescence occurs in an age-related cataract.

Capsulorhexis in intumescent cataracts is challenging.Upon puncturing the anterior capsule, rapiduncontrolled tear progression toward the lens periphery usually occurs, resulting in argentinian flag sign.[5] Moreover, egress of liquid cortexim pairs the surgeon's visualization.

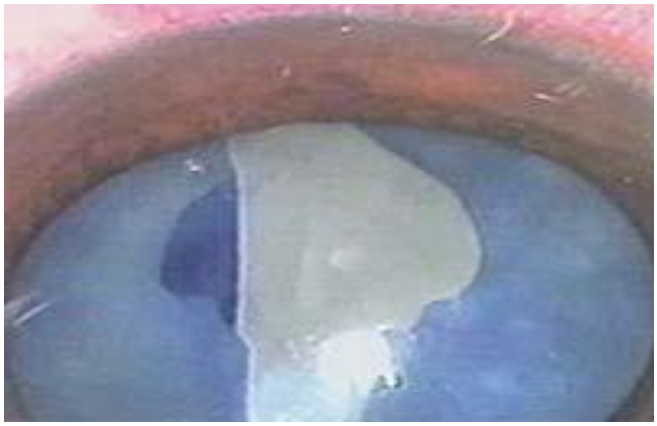


Figure 14: Argentinian flag sign

Generalrecommendations for capsulorhexis in intumescent cataractinclude high microscopic magnification with aslow focusing speed as well as elimination of extraneousoperating room lights and routine use of a viscoelasticagent.[4]

Various methods have been described for performing CCC in white intumescent cataract such as:

1. Needle aspiration technique.[34]
2. Two stage capsulorhexis.[34]
3. Phacocapsulotomy.[5]

NEEDLE ASPIRATION TECHNIQUE:

1. 26-gauge needle on a syringe is introduced into an intact anterior capsule.
2. The needle is used to aspirate the liquefied cortex, thereby depressurizing the nucleus, which facilitates a controlled capsulorhexis.
3. Additionally, a highly cohesive ophthalmic viscosurgical device (OVD) is injected to pressurize the anterior chamber against the pressure of the intumescent lens, which can facilitate continuous curvilinear capsulorhexis (CCC) completion.

Advantages:

1. Manual, not machine dependant.
2. Less expensive.

Disadvantages:

1. Incomplete depressurisation.
2. Uncontrolled aspiration.

TWO STAGE CAPSULORHEXIS:

Gimbel and associates, in a prospective observational study of intumescent white cataracts, suggested the advantage of a deliberately small continuous curvilinear capsulorhexis (First stage), which is secondarily enlarged (Second stage).

1. A small ring in anterior capsule is made by making a small puncture in anterior capsule with bent cystitome or 26 gauge needle and forming an edge of the anterior capsule.
2. The edge of anterior capsule is grasped and small ring of about 2mm is formed.
3. The pressure in the bag is lowered by aspirating the cortical fluid from the capsular bag.
4. Then the anterior chamber is reformed with OVD.
5. A large ring of 5-6mm in the anterior capsule is formed by making a new tear in the edge of small ring with vannas scissor.

PHACOCAPSULOTOMY:

In this new technique, the phacoemulsification tip is introduced through the centre of anterior capsule and portion of the lens is aspirated (this simultaneously creates the initial anterior capsule puncture and removes some of the liquefied cortex and nucleus).[5]

1. The phacoemulsification tip is introduced in non irrigating mode with bevel of the tip facing upwards and directed at a downward angle and placed over the center of the anterior capsule.
2. The settings used during phacocapsulotomy are a power 40 %, a vacuum of 200 mm Hg and an aspiration flow rate of 28 cc/min.
3. The foot pedal is pressed to position three and the anterior capsule is punctured with the phaco tip.
4. This creates the initial anterior capsule puncture, and the phaco tip is introduced into the lens.Milky cortex will become visible and is quickly aspirated into the handpiece.

5. The phaco tip is further embedded into the nucleus to sculpt the nucleus and further remove the milky cortex. Once enough of the cortex and fluid is removed, the phacohandpiece is removed from the eye.
6. OVD is then injected to reform the anterior chamber and the nonuniform tear of the anterior capsule is visualized. Next, using a capsulorhexis forceps, a leaflet of the anterior capsule is grasped, and the capsulorhexis is completed in a curvilinear fashion.

Advantages:

1. Depressurization is complete.
2. Controlled aspiration is possible.
3. Technically easy.
4.

Disadvantages:

1. Machine dependent, prone for technical problems(stoppage of the machine).

MATERIALS

AND

METHODS

MATERIALS AND METHODS

TITLE OF THE STUDY:

"Comparative study between phacocapsulotomy and needle aspiration in phacoemulsification of white intumescent cataract".

SOURCE OF DATA:

Minimum of 100 patients diagnosed with white intumescent cataract were selected for this prospective study at R.L.JALAPPA HOSPITAL AND RESEARCH CENTRE, TAMAKA, KOLAR attached to SRI DEVARAJ URS MEDICAL COLLEGE between December 2013 and June 2015.

SAMPLE SIZE:

A total number of 100 patients with white intumescent cataract were selected for the study . These patients were divided into two groups :

Group I: Phacoemulsification with phacocapsulotomy technique -50 patients.

Group II: Phacoemulsification with needle aspiration technique -50 patients.

INCLUSION CRITERIA:

1. Senile white intumescent cataracts.

EXCLUSION CRITERIA:

Intumescent cataracts associated with:

1. Corneal opacity.
2. Dry eye.
3. Amblyopia.
4. Anisometropia.
5. Glaucoma.
6. Retinal vascular diseases.

PREOPERATIVE EVALUATION.

- Detailed history of any previous ocular disease or surgery.
- Visual acuity recording by Snellen's chart.
- Slit lamp biomicroscopic examination for evidence of the following findings:
    a. Corneal clarity (endothelial status)
    b. Presence of synechiae
    c. AC (depth, cells, flare, vitreous)
    d. Iris –iridodonesis, iridectomies, posterior synechiae
    e. Type of cataract
    f. Phacodonesis or frank subluxation / dislocation of lens
    g. Pupillary reactions
    h. Pseudoexfoliation in pupillary margins
    i. Evidence of epithelialisation
    j. Posterior capsule (adequacy of support and clarity)

- Examination by both direct and indirect ophthalmoscopy.
- Ultrasound B scan was done on patients with hazy media to evaluate posterior segment.
- Applanation tonometry.
- Lacrimal sac syringing.
- Keratometry .
- A scan with intraocular lens power calculation by SRK-2 formula .
- General physical and systemic examination including cardiovascular system and respiratory system examination.
- Blood pressure recording and blood sugar estimation was done.
- Sensitivity to local anaesthetics tested.
- Informed and written consent for surgery.

SURGICAL TECHNIQUE

All patients were given systemic antibiotics (tablet ciprofloxacin 500mg b.d.) on the preoperative day. On the day of surgery pupils were dilated adequately using instillation of 0.8% tropicamide and 5% phenylephrine eye drops every 10 minutes, one hour before surgery. To sustain the pupil dilatation a anti- prostaglandin eye drops such as flubiprofen was instilled three times one day before surgery and half hourly for two hours immediately before surgery.

SURGICAL TECHNIQUE IN GROUP A (Phacocapsulotomy):

1. Peribulbaranaesthesia with 2% xylocaine, 0.5% bupivacaine & 15000U hylase.
2. The eye to be operated is painted, draped and prepared for surgery under aseptic precautions.
3. Universal wire speculum is applied.
4. A self sealing 2.8mm clear corneal temporal incision is made.
5. Side-port entry is made with the help of 1.5mm valvular corneal incision at 9^0clock position.
6. The phacoemulsification tip is introduced in non irrigating mode with bevel of the tip facing upwards and directed at a downward angle and placed over the center of the anterior capsule.
7. The settings used during phacocapsulotomy are a power 40 %, a vacuum of 200 mm Hg and an aspiration flow rate of 28 cc/min.
8. The foot pedal is depressed and the anterior capsule is punctured with the phaco tip.
9. This creates the initial anterior capsule puncture, and the phaco tip is introduced into the lens.Milky cortex will become visible and is quickly aspirated into the handpiece.
10. The phaco tip is further embedded into the nucleus to sculpt the nucleus and further remove the milky cortex. Once enough of the cortex and fluid is removed, the phacohandpiece is removed from the eye.
11. OVD is then injected to reform the anterior chamber and the nonuniform tear of the anterior capsule is visualized. Next, using a 26 gauge needle, a leaflet of the anterior capsule is grasped, and the capsulorhexis is completed in a curvilinear fashion.
12. Hydrodissectionis done to separate cortico-nuclear mass from the posterior capsule.

13. Emulsification of nucleus using direct chop technique.
14. Cortical matter was removed by irrigation and aspiration.
15. Foldable Posterior chamber intraocular lens was placed in the capsular bag.
16. The viscoelastic was cleared from the anterior chamber.
17. Subconjunctival Gentamycin and Dexamathasone 0.5cc was given.
18. Pad and bandage applied.

SURGICAL TECHNIQUE IN GROUP B (Needle aspiration):

1. Peribulbaranaesthesia with 2% xylocaine, 0.5% bupivacaine & 15000U hylase.
2. The eye to be operated is painted, draped and prepared for surgery under aseptic precautions.
3. Universal wire speculum is applied.
4. A self sealing2.8mm clear corneal tunnel incision is made.
5. Side-port entry is made with the help of 1.5mm valvular corneal incision at 9^0clock position.
6. 26-gauge needle on a syringe is introduced into an intact anterior capsule.
7. The needle is used to aspirate the liquefied cortex, thereby depressurizing the nucleus, which facilitates a controlled capsulorhexis.
8. Additionally, a highly cohesive ophthalmic viscosurgical device (OVD) is injected to pressurize the anterior chamber against the pressure of the intumescent lens, which can facilitate continuous curvilinear capsulorhexis (CCC) completion.
9. Hydrodissection is done to separate cortico-nuclear mass from the posterior capsule.
10. Emulsification of nucleus using direct chop technique.

11. Cortical matter was removed by irrigation and aspiration.
12. Foldable Posterior chamber intraocular lens was placed in the capsular bag.
13. The viscoelastic was cleared from the anterior chamber.
14. Subconjunctival gentamycin and dexamathasone 0.5cc was given.
15. Pad and bandage applied.

Here we shall be assessing intraoperativelyin both groups for

1. Elevation of flap and continuation of capsulorhexis.
2. Radial extension of capsulorhexis.
3. Discontinuity of capsulorhexis.
4. Decrease in intralenticular pressure i.e total decompression by assessing leakage of liqueified cortex.
5. Centration of capsulorhexis.
6. Posterior capsular rupture.
7. Vitreous loss.

Postoperatively all patients received a course of topical moxifloxacin 0.5% and prednisolone acetate 1% eye drops second hourly for a week, followed by a tapering dose for 4 weeks along with nepafenac eye drops 0.3% three times a day for 4 weeks. Systemic antibiotic Tab Ciprofloxacin 500mg was given for 1 day before and continued for 5 days postoperatively. Tab Diclofenac50 mg stat was given in case the patient complained of pain.

Postoperatively visual outcome and any evidence ofcorneal edema, iritis, and rise in IOP were noted.

STATISTICAL ANALYSIS

STATISTICAL ANALYSIS

Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean ± SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance. The following assumptions on data is made, **Assumptions: 1.**Dependent variables should be normally distributed, 2.Samples drawn from the population should be random, Cases of the samples should be independent

Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups (Inter group analysis) on metric parameters.

Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups.

OBSERVATION AND RESULTS

OBSERVATION AND RESULTS

A prospective, comparative study of phacocapsulotomy versus needle aspiration in white intumescent cataracts was conducted at R.L.Jalappa hospital attached to Sri DevarajUrs Medical College. 100 cases were studied, of which 50 cases (Group I) underwent phacocapsulotomy and remaining 50 cases (Group II) underwent needle aspiration technique.

TABLE 1: AGE DISTRIBUTUION

Age in years	Group I		Group II	
	No	%	No	%
50-60	16	32.0	15	30.0
61-70	**24**	**48.0**	**26**	**52.0**
71-80	7	14.0	9	18.0
>80	3	6.0	0	0.0
Total	50	100.0	50	100.0
Mean ± SD	66.06±8.97		64.52±6.91	

In the present study out of 50 patients in each group majority of the patients were in the age range of 61-70 yrs i.e. 24 (48%) patients in group I and 26 (52%) patients in group II. 16 (32%) patients in group I and 15 (30%) patients in group II were in the age range of 50-60yrs. 7 (14%) patients in group I and 9 (18%) patients in group II were in the age range of 71-80yrs. 3 (6%) patients in group II were in age group > 80 yrs. Mean age group was 66.06±8.97 in group I and 64.52±6.91 in group II. P value by chisquare test showed 0.339, indicating no statistical significance.

GRAPH 1: AGE DISTRIBUTION

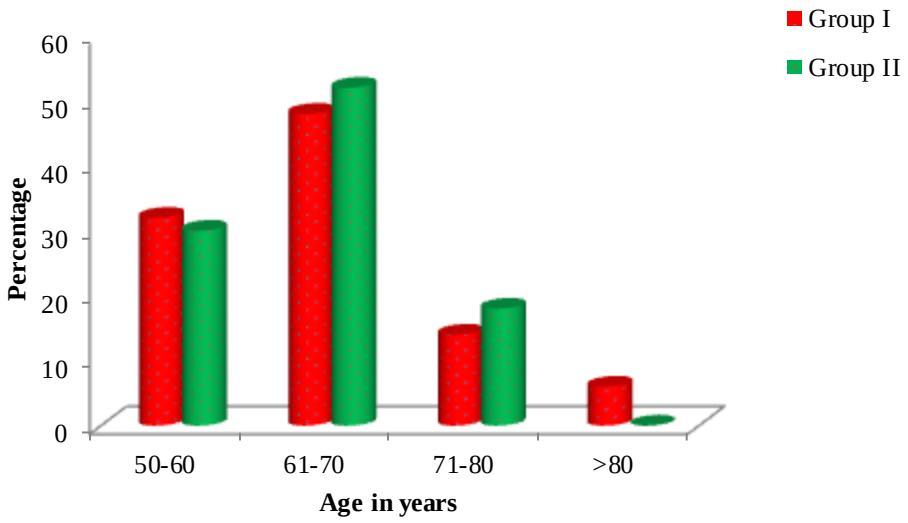


TABLE 2:SEX DISTRIBUTION

Gender	Group I		Group II	
	No	%	No	%
Female	31	62.0	24	48.0
Male	19	38.0	26	52.0
Total	50	100.0	50	100.0

In the present study in group I, 31 (62%) patients were female and 19(38%) were male. In group II 24(48%) patients were female and 26(52%) patients were male. p value by chisquare test showed 0.159, indicating no statistical significance in between the gender distribution.

GRAPH 2:SEX DISTRIBUTION

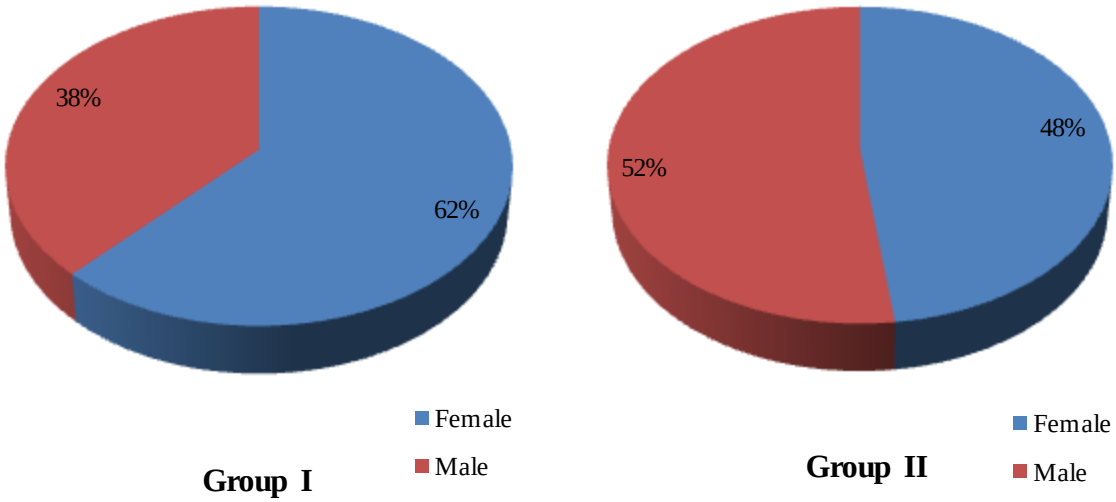


TABLE 3:EYE INVOLVED

Eye Involved	Group I		Group II	
	No	%	No	%
Left Eye	16	32.0	14	28.0
Right Eye	34	68.0	36	72.0
Total	50	100.0	50	100.0

In the present study we see that out of 100 eyes which got operated, 30(30%) was in right eye and 70(70%) was in left eye. p value by chisquare test showed 0.663, indicating no statistical significance.

GRAPH 3:EYE INVOLVED

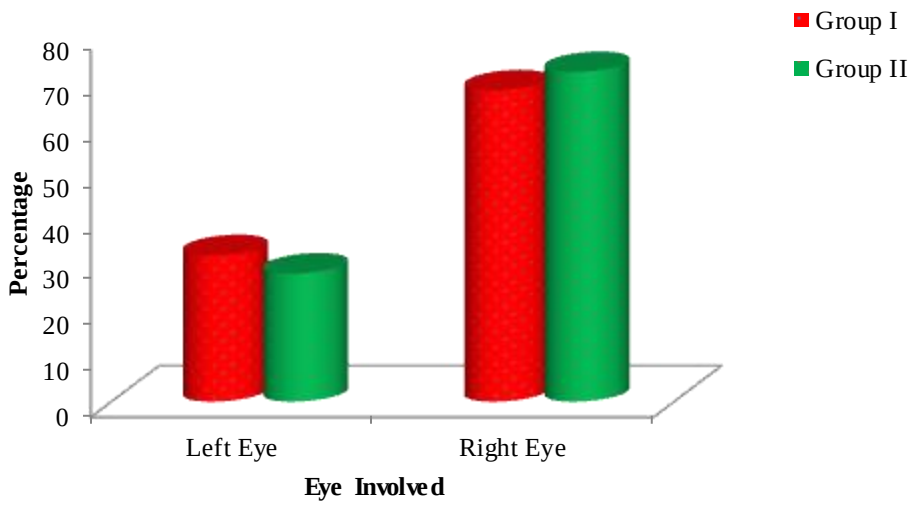


TABLE 4:PREOPERATIVE VISUAL ACUITY

VISUAL ACUITY	GROUP I		GROUP II	
	NO OF PATIENTS	%	NO OF PATIENTS	%
CF at 1M	11	22%	08	16%
HM +	39	78%	42	84%
TOTAL	50	100	50	100

In the present study, preoperative visual acuity was recorded in both Group I i.e. Phacocapsulotomy and in group II i.e. Needle aspiration. In group I we see visual acuity was CF at 1M in 11(22%) patients and Hand movements (HM) in 39(78%) patients. In group II we see visual acuity was CF at 1M in 8(16%) patients and Hand movements (HM) in 42(84%) patients.p value by chisquare test showed 0.5 indicating no statistical significance.

GRAPH 4:PREOPERATIVE VISUAL ACUITY

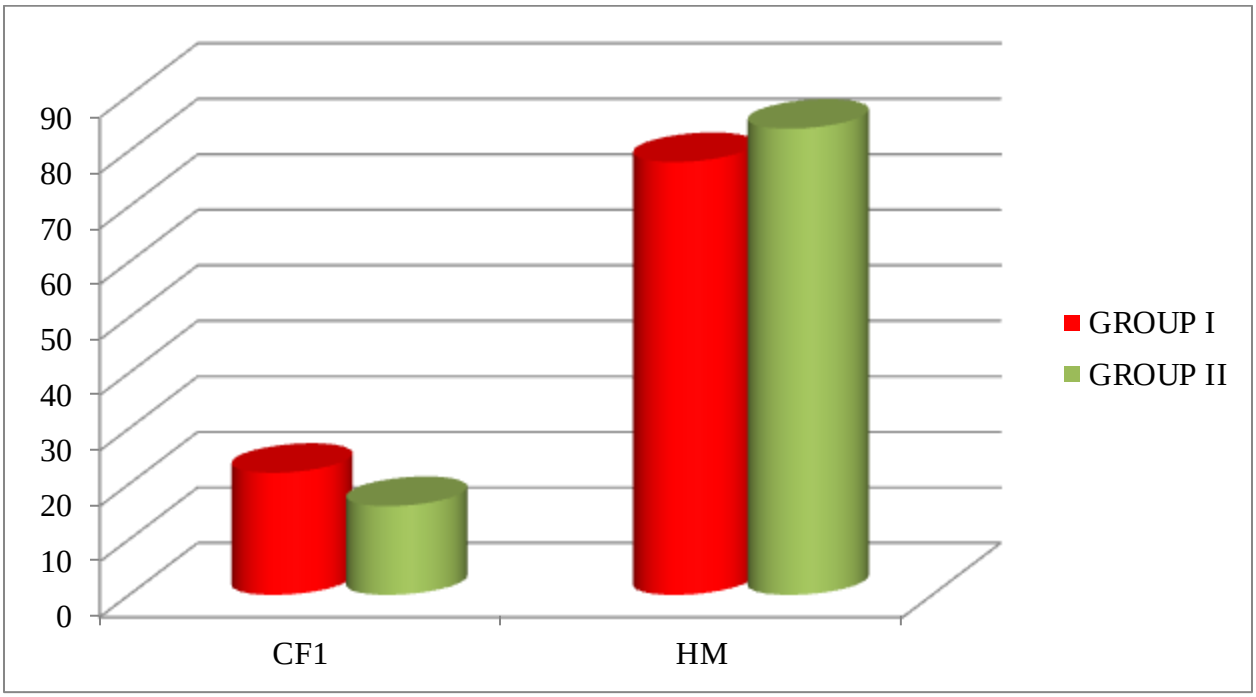


TABLE 5: INTRAOPERATIVE COMPLICATIONS

Intraoperative complications	Group I (n=50)		Group II (n=50)		P value
	No	%	No	%	
Flap elevation	50	100.0	46	92.0	0.117
Extension into periphery	1	2.0	8	16.0	0.041
Centration of capsulorhexis	44	88.0	41	82.0	0.401
Decrease in intralenticular pressure	44	88.0	26	52.0	0.037
Posterior capsule rupture	1	2.0	3	6.0	0.617
Vitreous loss	0	0.0	1	2.0	1.000

In the present study intra operative complications was documented in both the groups. Flap elevation was observed in all patients (100%) in group I and only 46(92%) patients in group II, which was not statistically significant (p =0.117). We see that extension into periphery was seen in 1(2%) patient in group I and 8(16%) patients in group II with **p value 0.041 which was statistically significant.** 44(88%) patients in group I had centration of capsulorhexis while only 41 patients in group II had, with p value 0.401 which was not statistically significant. Decrease in intralenticular pressure was observed in 44(88%) patients in group I and 26(52%) patients in group II which **was statistically significant (p=0.037).** There was 1(2%) posterior capsule rupture observed in group I and 3(6%) in group II which was not statistically significant (p value = 0.617). Vitreous loss was not observed in Group 1 but 1(2%) patient had in group II (p value=1%), which was not statistically significant.

GRAPH 5: INTRAOPERATIVE COMPLICATIONS

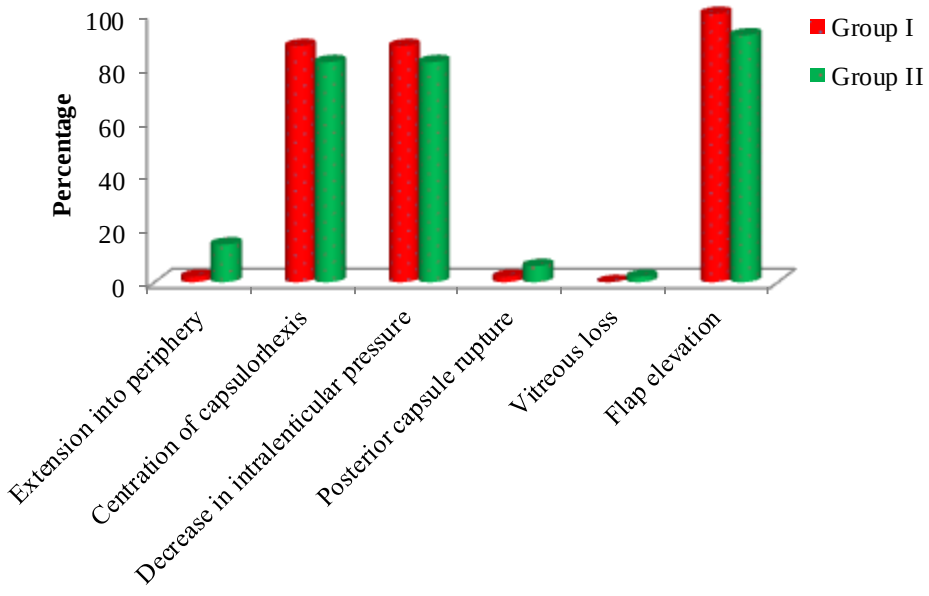


TABLE 6: POSTOPERATIVE BESTCORRECTED VISUAL ACUITY IN GROUP I – PHACOCAPSULOTOMY

BCDV	1st day	1st week	1st month	3rd month	6th month	% change
• 6/6-6/9	38(76%)	40(80%)	44(88%)	44(88%)	44(88%)	88.0%
• 6/12-6/18	8(16%)	9(18%)	5(10%)	5(10%)	5(10%)	10.0%
• 6/24-6/36	4(8%)	1(2%)	1(2%)	1(2%)	1(2%)	2.0%
• 6/60	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0.0%
• <6/60	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	-100.0%

In the present study best corrected visual acuity was documented in both the groups. We see that in groupI on first post operative day 38(76%) patients had visual acuity in the range of 6/6-6/9, 8(16%) patients had visual acuity in the range of 6/12-6/18 and 4(8%) patients had visual acuity in the range of 6/24-6/36. On 1 week post operative 40(80%) patients had visual acuity in the range of 6/6-6/9, 9(18%) patients had visual acuity in the range of 6/12-6/18 and 1(2%) patient had visual acuity in the range of 6/24-6/36. On 1 month post operative44(88%) patients had visual acuity in the range of 6/6-6/9, 5(10%) patients had visual acuity in the range of 6/12-6/18 and 1(2%) patient had visual acuity in the range of 6/24-6/36. The BCDV remained the same on subsequent follow ups.

GRAPH 6: POSTOPERATIVE BESTCORRECTED VISUAL ACUITY IN GROUP I-PHACOCAPSULOTOMY

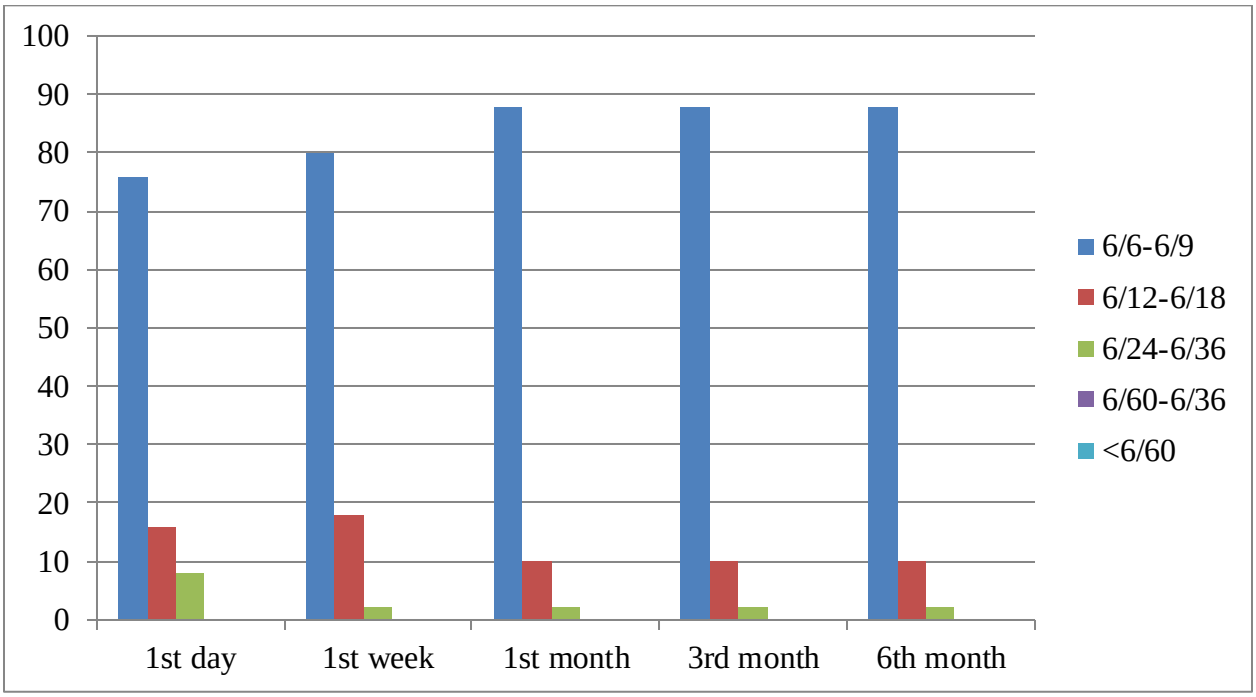


TABLE 7: POSTOPERATIVE BESTCORRECTED VISUAL ACUITY IN GROUP II-NEEDLE ASPIRATION

BCDV	1st day	1st week	1st month	3rd month	6th month	% change
• 6/6-6/9	35(70%)	40(80%)	43(86%)	43(86%)	43(86%)	86.0%
• 6/12-6/18	9(18%)	9(18%)	6(12%)	6(12%)	6(12%)	12.0%
• 6/24-6/36	6(12%)	1(2%)	1(2%)	1(2%)	1(2%)	2.0%
• 6/60	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0.0%
• <6/60	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	-100.0%

In the present study best corrected visual acuity was documented in both the groups. We see that in group II on first post operative day 35(70%) patients had visual acuity in the range of 6/6-6/9, 9(18%) patients had visual acuity in the range of 6/12-6/18 and 6(12%) patients had visual acuity in the range of 6/24-6/36. On 1 week post operative 40(80%) patients had visual acuity in the range of 6/6-6/9, 9(18%) patients had visual acuity in the range of 6/12-6/18 and 1(2%) patient had visual acuity in the range of 6/24-6/36. On 1 month post operative 43(86%) patients had visual acuity in the range of 6/6-6/9, 6(12%) patients had visual acuity in the range of 6/12-6/18 and 1(2%) patient had visual acuity in the range of 6/24-6/36. The BCDV remained the same on subsequent follow ups.

GRAPH 7: POSTOPERATIVE BESTCORRECTED VISUAL ACUITY IN GROUP II - PHACOCAPSULOTOMY

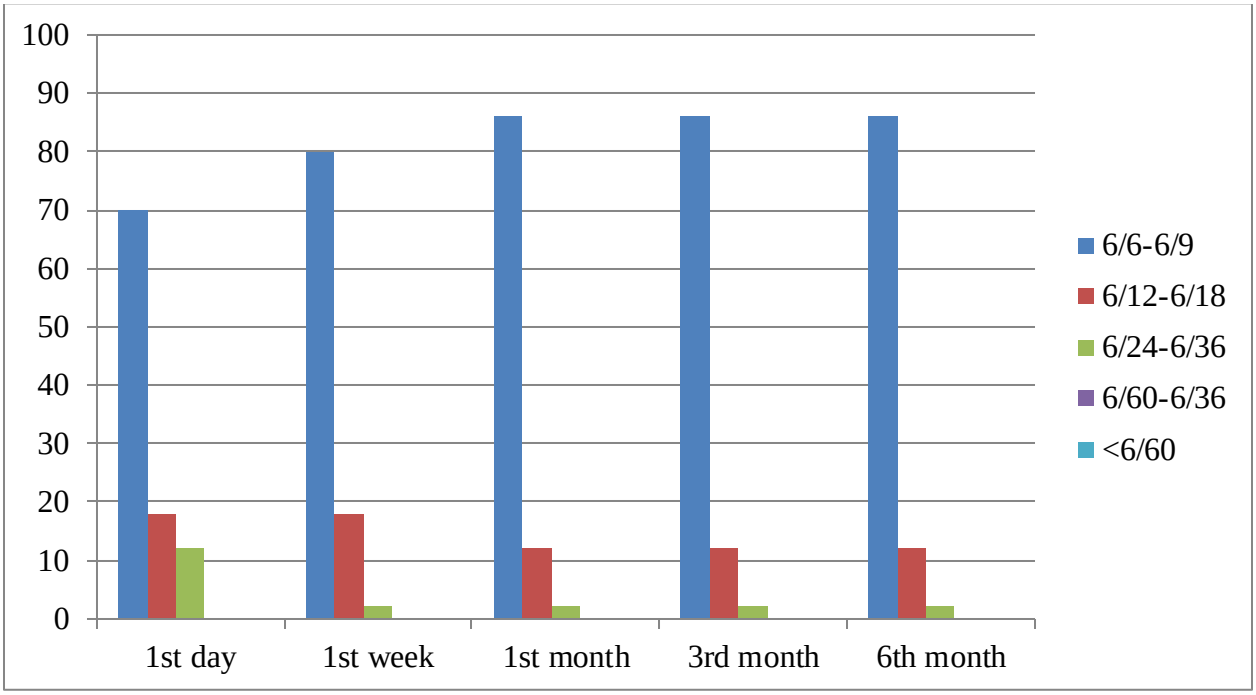
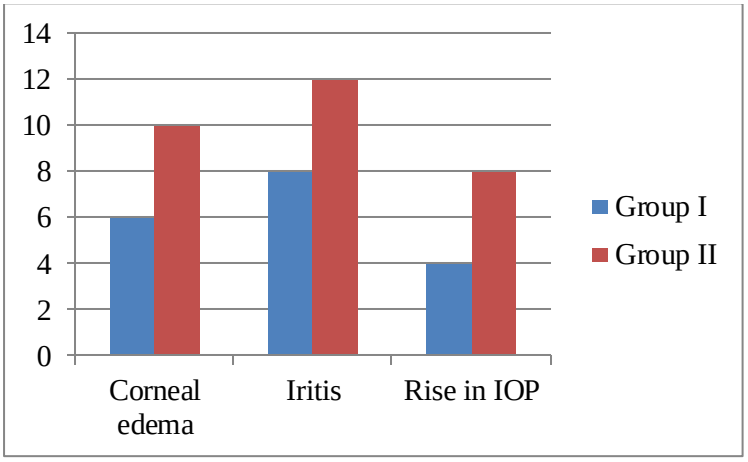


TABLE 8: POSTOPERATIVE COMPLICATIONS

Post operative Complications	Group I (n=50)		Group II (n=50)		P value
	No	%	No	%	
Corneal edema	3	6.0	5	10.0	0.715
Iritis	4	8.0	6	12.0	0.505
Rise in IOP	2	4.0	4	8.0	0.625

In the present study postoperative complications was documented in both the groups. Corneal edema was observed in 3(6%) cases in group I and 5(10%) cases in group II (p value=0.715), which was not statistically significant. Four (8%) patients in group I and 6(12%) patients in group II had iritis with p value 0.505 which was not statistically significant. Also postoperatively there was rise in IOP in 2 (4%) patients in group I and 4 (8%) patients in group II (p value = 0.625), which was not statistically significant.

GRAPH 8: POSTOPERATIVE COMPLICATIONS



DISCUSSION

DISCUSSION

This study was done to compare the intraoperative complications and postoperative visual outcome between phacocapsulotomy technique and needle aspiration technique in phacoemulsification of white intumescent cataracts.

Hundred patients attending to outpatient department of ophthalmology, R.L.JALAPPA HOSPITAL AND RESEARCH CENTRE, attached to SRI DEVARAJ URS MEDICAL COLLEGE, TAMAKA, KOLAR with white intumescent cataracts fulfilling the inclusion criteria framed were selected for phacoemulsification under peribulbaranaesthesiabetween December 2013 to July 2015. The patients were randomly divided into two groups of 50 patients each (Group I-Phacocapsulotomy&II- Needle aspiration). Detailed preoperative evaluation of ocular and systemic examination was done.

Of the total (Table 1) 100 patients selected for the study majority of the patients in both the groups were in the age range of 61-70 yrs and majority were female patients. Preoperative Snellen's chart visual acuity recording in both Group I i.e. Phacocapsulotomy and in group II i.e. needle aspiration group was done.

After all necessary preoperative investigations patients were posted for phacoemulsification surgery. In group I phacocapsulotomy technique was done to facilitate capsulorhexis and in group II needle aspiration technique was done to achieve the same, followed by phacoemulsification with foldable IOL implantation.

In the present study **Intra operative complications** was documented in both the groups.Flap elevation was observed in all patients in **group I (Phacocapsulotomy).** We see that extension into periphery was seen in 1(2%) patients, forty four (88%) patients had centration of capsulorhexis, decrease in intralenticular pressure was observed in 44(88%) patients in groupI. There was 1(2%) patient with posterior capsule rupture and no vitreous loss documented in group I.

Flap elevation was observed in 46(92%) patients, extension into periphery was seen in 8(16%) patients,41(82%) patients had centration of capsulorhexis in **group II (Needle aspiration).**Decrease in intralenticular pressure was observed in 26(52%) patients in group II. There were3(6%) patients withposterior capsule rupture and vitreous loss was observed in 1(2%) patient in group II.

Christopher C Teng has described phaocapsulotomy technique as an effective technique to debulk the lens and remove the impetus for the argentinian flag sign to occur. The main complication that he encountered using this technique was wound burn which occurred when phaco tip embedded immediately into the nucleus and occluded leading to interruption of aspiration. He also suggested that wound burn could be effectively countered by pulsing the footpedal upon entry of the phaco tip or by using the burst mode.[5]

Mahalingam P concluded that phacocapsulotomy as a safe and effective technique which prevents sudden extension of capsulorhexis by depressurizing the intralenticular pressure and debulking the lens. Furthermore he also suggested that this technique also prevented the spontaneous peripheral migration of the capsulorhexis edge, thus reducing the concurrent complications. [35]

Guimbel and associates analyzed 2,967 consecutive cataract cases in a prospective observational study of the incidence of intumescent cataracts and showed that 45.45% of the needle aspiration groups had leakage of the liquefied cortex; in addition, the surgeon detected high intracapsular pressure in at least 61% of cases in the needle aspiration group. Guimbel and associates revealed that 11.7% of intumescent cases had anterior capsule tears during the first capsulotomy.[34]

In a retrospective study of 212 consecutive patients with white cataracts, **Chakrabartiet al.** showed incomplete capsulorhexis in 28.3% of cases, a posterior capsular tear in 1.9% of cases, and the conversion to a manual non-phacoemulsification technique in 1.9% of cases, using needle aspiration technique.[36]

Vasavada et al. examined 60 eyes (60 patients) with senile white mature cataracts in which a small capsulorhexis was attempted initially, and endophacoemulsification was performed. The capsulorhexis was enlarged before intraocular lens implantation. In that series, CCC was achieved in 57 eyes (95%); in addition, the intracapsular pressure rose in 24 eyes (40%). [37]

Kara junior et al.in their study showed in needle aspiration, discontinuity of capsulorhexis occurred in 30% of cases. CCC was achieved in 53.80% of cases, and the intracapsular pressure was judged to be increased in 45.16%of cases using needle aspiration technique.[38]

A prospective randomized study where needle aspiration technique in intumescent cataract was studied revealed that high intracapsular pressure was noticed in 66% of cases. During CCC, there was more tendency of the edge of the capsule to go peripheral in 18 cases (60.0%). Centralisation of the capsulorhexis was found in (86.6%).[39]

In our study, extension of CCC was seen in 2% of cases and control of intralenticularpressure was achieved in 88 % of cases when the phacocapsulotomy technique was used. The findings were different from cases where needle aspiration technique was used where, extension of CCC was seen in 16 % of cases and control of intralenticularpressure was achieved only in 52% of cases. We found statistically significant difference among the two techniques in terms of extension of CCC and decrease in intralenticular pressure. We did not find any statistical differences in flap elevation, centration of CCC, posterior capsule rupture and vitreous loss.

The higher success rate achieved for CCC using phacocapsulotomy technique is assumed to result from controlled aspiration and increased safety when compared to needle aspiration technique.

In our study, we see that in **group I(Phacocapsulotomy)** on first post-operative day 38(76%) patients had visual acuity in the range of 6/6-6/9, 8(16%) patients had visual acuity in the range of 6/12-6/18 and 4(8%) patients had visual acuity in the range of 6/24-6/36. On 1 week post operative 40(80%) patients had visual acuity in the range of 6/6-6/9, 9(18%) patients had visual acuity in the range of 6/12-6/18 and 1(2%) patient had visual acuity in the range of 6/24-6/36. On 1 month post operative 44(88%) patients had visual acuity in the range of 6/6-6/9,

5(10%) patients had visual acuity in the range of 6/12-6/18 and 1(2%) patient had visual acuity in the range of 6/24-6/36. The BCDV remained the same on subsequent follow ups.

In needle aspiration group, on first post operative day 35(70%) patients had visual acuity in the range of 6/6-6/9, 9(18%) patients had visual acuity in the range of 6/12-6/18 and 6(12%) patients had visual acuity in the range of 6/24-6/36. On 1 week post operative 40(80%) patients had visual acuity in the range of 6/6-6/9, 9(18%) patients had visual acuity in the range of 6/12-6/18 and 1(2%) patient had visual acuity in the range of 6/24-6/36. On 1 month post operative 43(86%) patients had visual acuity in the range of 6/6-6/9, 6(12%) patients had visual acuity in the range of 6/12-6/18 and 1(2%) patient had visual acuity in the range of 6/24-6/36. The BCDV remained the same on subsequent follow ups.

The BCVA at the end of 6 month was 6/6-6/9 in 88% of patients in group I (Phacocapsulotomy) and 86% of patients in group II (Needle aspiration) which was not statistically significant. (p=0.675)

In a study done by **vasavada et al,** best corrected visual acuity of 6/6 to 6/9 was achieved in 95% at end of first month by using needle aspiration technique which is comparable to our study (86%).[37]

In a study done by **chakrabarti et al,** best corrected visual acuity of 6/9 or better was achieved in 93.9% at end of first month by using needle aspiration technique which is fairly comparable to our study (86%), and in the same study two patients had best corrected visual acuity worse than 6/60 which was attributed to retinitis pigmentosa with consecutive optic atrophy and previous failed macular hole surgery in the other.[36]

In the **present study,postoperative complications** was documented in both the groups. Corneal edema was observed in 3(6%) cases in group I and 5(10%) cases in group II (p value=0.715), which was not statistically significant. Four (8%) patients in group I and 6(12%) patients in group II had iritis with p value 0.505 which was not statistically significant. Also postoperatively there was rise in IOP in 2 (4%) patients in group I and 4 (8%) patients in group II (p value = 0.625), which was not statistically significant.

In a study done by **vasavada et al,**26% had central corneal edema on first postoperative day. 15% had mild to moderate stromal edema and 20% , diffuse epithelial edema. Our study showed 16% corneal edema, of which more were found in needle aspiration group (10%), which is less compared to the study.[37]

Thus, in our series, the main intraoperative difficulties was obtaining an intact capsulorhexis. The challenge of performing CCC in eyes with white intumescent cataract is well documented, and various suggestions have been offered.Challenges arise because of the lack of a red reflex, poor contrast between the anterior capsule and the underlying cortical fibers, high intralenticular pressure in intumescent cataracts, leaking of lens matter from the anterior capsular puncture sites, and the occasional presence of anterior capsule fibrosis. General recommendations for CCC in eyes with white intumescent cataract include dimming the room lights, increasing the microscope's magnification, using oblique illumination, routinely using a viscoelastic agent. Other recommendations we have not tried but that may be helpful are the use of an endoilluminator, the hemocoloration technique,[40] fluorescein staining of the anterior capsule[22] and the use of a high-frequency diathermy probe[19] to cut the anterior capsule.

White intumescent cataract has ceased to be a contraindication to phacoemulsification at our institution. However, we realize that for consistent results, appropriate modifications must be incorporated in certain steps, and for CCC we have found out that phacocapsulotomy technique can be a better option as compared to needle aspiration. The nucleus is removed by the divide and conquer or phaco chop technique, depending on the nucleus mobility. Inthe presence of a CCC tear, nucleus sculpting shouldproceed gently and nucleus cracking can be safely accomplished at a meridian farthest from the CCC tear.The PC IOL should be oriented at right angles to theCCC tear.

CONCLUSION

CONCLUSION

In our study we found that radial extension of CCC occurred more in Needle aspiration as compared to Phacocapsulotomy which was statistically significant. Also the intralenticular pressure was significantly decreased when phacocapsulotomy technique was used as compared to needle aspiration. There were no statistical differences between the other intraoperative variables measured such as flap elevation, centration of CCC, posterior capsule rupture and vitreous loss.

Complications like post operative iritis, corneal edema and rise in IOP were noticed in both the groups which resolved after 1 month, which also had no significant statistical differences. At end of six month postoperative, both the groups had better visual outcome which was not statistically significant.

We found that, phacocapsulotomy technique is a simple, controlled and effective technique that extends the possibility of routinely achieving a CCC and thus preventing radial extension of CCC. It also allows for safe phacoemulsification and well centered in the bag IOL implantation.

SUMMARY

SUMMARY

This study was done to compare the safety and efficacy of phacocapsulotomy technique versus needle aspiration and visual outcome in white intumescent cataracts.

Hundred patients attending to out patient department of ophthalmology, R.L.JALAPPA HOSPITAL AND RESEARCH CENTRE attached to SRI DEVARAJ URS MEDICAL COLLEGE,, TAMAKA, KOLAR with white intumescent cataracts fulfilling the inclusion criteria framed were selected for phacoemulsification with foldable IOL implantation under peribulbaranaesthesia between December 2013 to July 2015 .

The patients were randomly divided into two groups of 50 patients each (group I- Phacocapsulotomy and group II – Needle aspiration).After detailed preoperative evaluation, phacoemulsification with foldable IOL implantation was performed.

Intraoperative variables such as flap elevation, radial extension of CCC, centration of CCC, decrease in intralenticular pressure, posterior capsule rupture and vitreous loss were recorded and compared between two groups.

Visual acuity unaided,with pinhole vision, best corrected visual acuity and complications if any were recorded in each patient postoperatively on first day, first week, first month, third month and sixth month.

Statistical analysis was applied to compare the intraoperative effects and visual recovery. Complications if any in between the two groups were also studied.

One (2%) patient out of 50 patients who underwent phacocapsulotomy technique had radial extension of CCC compared to 8(16%) out of 50 patients in needle aspiration group which **was statistically significant (p=0.04).** Decrease in intralenticular pressure was observed in 44(88%) patients in group I and 26(52%) patients in group II which **was statistically significant (p=0.037).** There were no statistical differences between the other intraoperative variables measured such as flap elevation, centration of CCC, posterior capsule rupture and vitreous loss.

At end of one month postoperative period, 44(88%) patients out of 50 patients in phacocapsuoltomy group had postoperative visual acuity ranging between 6/6 -6/9 ascompared to 43(86%) patients out of 50 patients in needle aspiration group. No statistical significanctdifferences was noted between two groups in terms of visual outcome.

Complications like post operative iritis& corneal edema were noticed in both the groups which resolved after 1 month, which also had no significant statistical differences.

We found that, phacocapsulotomy technique is a simple, controlled and effective technique that extends the possibility of routinely achieving a CCC and thus preventing radial extension of CCC. It also allows for safe phacoemulsification and well centered in the bag IOL

BIBLIOGRAPHY

BIBLIOGRAPHY

1. Gunnlaugsdottir E, Arnarsson A, Jonasson F. Prevalence and causes of visual impairment and blindness in Icelanders aged 50 years and older: the Reykjavik Eye Study. ActaOphthalmol2008;86:778-85.

2. Sapkota YD, Pokharel GP, Nirmalan PK. Prevalence of blindness and cataract surgery in Gandaki Zone, Nepal. Br J Ophthalmol2006;90:411-6.

3. Jose R. National Programme for control of blindness. Indian J Community Health 1997;3:5-9.

4. Bhattacharjee K, Bhattacharjee H, Goswani BJ, Sarma P. Capsulorhexis in intumescent cataract. J cataract refractive surgery 1999; 25:1045-1047.

5. Teng CC. Preventing the Argentinian Flag Sign: Phacocapsulotomy. EW News and opinion.2013; 9:14-15.

6. Bissen-Miyajima H. Ophthalmic viscosurgical devices. CurrOpin ophthalmology 2008; 19:50-4.

7. Snell R S, Lemp M A. Clinical anatomy of the eye. 2nd ed. Boston: Blackwell Science Inc.;1998;P.197-204

8. Bron AJ, Tripathi RC, Tripathi BJ.Wolff's Anatomy of the Eye and Orbit. 8th ed. London: Chapman and Hall; 1997:P. 411-442

9.Kuszak JR, Brown HG: Embryology and anatomy of the lens. In: Albert D.M., Jakobiec F.A., ed. Principles and practice of ophthalmology. Basic sciences. Philadelphia: WB Saunders; 1994:P.82-96.

10.Yanoff M, Duker S. Ophthalmology. Mosby Ltd; 2004: (1): P. 241-5

11. Albert DM, Henkind P. Men of Vision. Lives of Notable Figures in Ophthalmology. WB Saunders; 1993

12. Thylefors B, Negrel AD, Pararajasegram R. Global data on blindness. Bull World Health Organ 1996; 74:319-24

13. Spalton D, Koch D. The constant evolution of cataract. British J of Ophthalmology 2000; 321(7272): 1304.

14. Assia EI, Apple DJ, Tsai JC, Lim ES. The elastic properties of the lens capsule in capsulorhexis. Am J Ophthalmol 1991; 111:628–32.

15. Steinert RF, Fine IH. Cataract surgery: technique, complications &management. 1st ed. Philadelphia: Saunders; 1995.

16. Kwitko ML, Kelman CD, editors. In: Kugler, editor. The history ofmodern cataract surgery. The Netherlands: The Hague; 1998.

17. Krag S, Thim K, Corydon L. Diathermic capsulotomyversus capsulorhexis: a biomechanical study. J Cataract Refract Surg 1997; 23:86–90.

18. Teus MA, Fagundez-Vargas MA, Calvo MA, Marcos A. Viscoelastic-injecting cystotome. J Cataract Refract Surg 1998; 24:1432–3.

19. Hansmann N, Richard G. Investigations on diathermy for anterior capsulotomy. Invest Ophthalmol Vis Sci 1991; 32:2155–9.

20. Pandey SK, Werner L, Escobar-Gomez M, Roig-Melo EA, Apple DJ. Dye-enhanced cataract surgery, part 1: anterior capsule staining for capsulorhexis in advance/ white cataract. J Cataract Refract Surg 2000; 26:1052–9.

21. Pandey SK, Werner L, Escobar-Gomez M, Werner LP,Apple DJ. Dye-enhanced cataract surgery, part 3:posterior capsule staining to learn posterior continuous curvilinear capsulorhexis. J Cataract Refract Surg 2000; 26:1066–71.

22. Hoffer KJ, McFarland JE. Intracameralsubcapsular fluorescein staining for improved visualization during capsulorhexis in mature cataracts. J Cataract RefractbnSurg 1993;19:566.

23. Neuhann T. Theory and surgical technique of capsulorhexis [in German]. KlinMonatsblAugenheilkol 1987;190:542–5.

24. Gimbel HV, Neuhann T. Continuous curvilinear capsulorhexis. J Cataract Refract Surg 1991;17:110–1.

25. Tahi H, Fantes F, Hamaoui M, Parel J-M. Small peripheral anterior continuous curvilinear capsulorhexis. J Cataract Refract Surg 1999;25:744–7.

26. Colvard DM, Dunn SA. Intraocular lens centration withcontinuous tear capsulotomy. *J Cataract Refract Surg*1990;**16**:312–4.

27. Mansour AM. Anterior capsulorhexis in hypermaturecataracts. J Cataract Refract Surg 1993;19:116–7.

28. Comer RM, Abdulla N, O'Keefe M. Radiofrequencydiathermycapsulorhexis of the anterior and posterior capsules in paediatric cataract surgery: preliminary results. J Cataract Refract Surg 1997;23:641–4.

29. Gimblel HV. Posterior continuous curvilinearcapsulorhexis and optic capture of the intraocular lens to prevent secondary opacification in paediatric cataract surgery. J Cataract Refract Surg 1997;23:652–6.

30. Melles GRJ, Waard PWT, Pameyer JH, HoudijnBeekhuis W. Trypan blue capsule staining to visualize the capsulonhexis in cataract sugery. J Cataract Refract Surg 1999;24:7–9.

31.Lee CP. Capsulorhexis–a 5-year experience. Eur J ImplantRefractSurg 1990; 2:27–31.

Gimbel HV, Kaye GB. Forceps-puncture continuous curvilinear capsulorhexis. J Cataract Refract Surg1997;23:473–5.

32.Horiguchi M, Miyake K, Ohta I, Ito Y. Staining of the lenscapsule for circular continuous capsulorhexis in eyes withwhitecataract. Arch Ophthalmol 1998; 116:535–537.

33. Rao SK, Padmanabhan R. Capsulorhexis in eyes with phacomorphic glaucoma. J Cataract Refract Surg1998;882–4.

34.Gimbel HV, Willerscheidt AB. What to do with limited view: the intumescent cataract. J Cataract Refract Surg 1993; 19:657–661.

35.Mahalingam P &Sambhav K. Phacocapsulotomy in intumescent cataract. Nepal J Ophthalmol 2014; 6:242-243.

36.Chakrabarti A, Singh S. Phacoemulsification in eyes with white cataract. J Cataract Refract Surg. 2000;26:1041-7.

37. Vasavada A, Singh R, Desai J. Phacoemulsification of white maturecataracts. J Cataract Refract Surg 1998; 24:270-7.

38. Kara-Junior N, Rodrigues de SanthiagoM, Kawakami A, Pedro Carricondo, Takashi HidaW. Mini-Rhexis For WhiteIntumescent Cataracts. Clinics (SaoPaulo). 2009; 64(4): 309–312.

39. Abdel Rahman El-SebaeySarhan. Two stages versus one stage capsulorhexis in White intumescent cataract.MMJ 2011; 24:45– 50.

40. Cimetta DJ, Gatti M, Lobianco G. Haemocoloration ofthe anterior capsule in white cataract CCC. Eur J ImplantRefract Surg 1995; 7:184–1854.

ANNEXURE

ANNEXURE: I

PROFORMA

TITLE:"COMPARATIVE STUDY BETWEEN PHACOCAPSULOTOMY AND NEEDLE ASPIRATION IN PHACOEMULSIFICATION OF WHITE INTUMESCENT CATARACT"

CASE NUMBER:

NAME:

AGE: SEX: I.P. NO./O.P. NO.:

DATE OF ADMISSION: DATE OF DISCHARGE:

PRESENTING COMPLAINTS:

HISTORY OF PRESENTING COMPLAINTS:

PAST HISTORY:

FAMILY HISTORY:

PERSONAL HISTORY:

GENERAL PHYSICAL EXAMI NATION:

SYSTEMIC EXAMINATION:

OCULAR EXAMINATION:

HEAD POSTURE

FACIAL SYMMETRY

OCULAR POSTURE

VISION RIGHT EYE LEFT EYE

-UNCORRECTED

-PINHOLE

-CORRECTED

	RIGHT EYE	LEFT EYE
OCULAR ADNEXA		
CONJUNCTIVA		
CORNEA		
AC		
IRIS		
PUPIL		
LENS		
FUNDUS		
BSCAN		
GONIOSCOPY		
IOT		
LACRIMAL SYRINGING		

FINAL DIAGNOSIS:

PLANNED SURGERY:

BIOMETRY:

K1:

K2:

AL:

IOL:

OPERATIVE NOTES:

DATE:

PROCEDURE:

INTRAOPERATIVE COMPLICATIONS:

Complications	Group I	Group II
Flap elevation		
Extension to periphery		
Centration of CCC		
PCR		
Vitreous loss		

POSTOPERATIVE VISUAL ACUITY

1 DAY	1 WEEK	1 MONTH	3 MONTH	6 MONTH

POSTOPERATIVE COMPLICATIONS

Complications	Group I	Group II
Corneal edema		
Iritis		
Rise in IOP		

ANNEXURE: II

INFORMED CONSENT FORM

"COMPARATIVE STUDY BETWEEN PHACOCAPSULOTOMY AND NEEDLE ASPIRATION IN PHACOEMULSIFICATION OF WHITE INTUMESCENT CATARACT"

White intumescent cataracts are challenging cases for most surgeons. In these eyes, during capsulorhexis creation, the pressure created by the hyperhydration of lens fibers can cause increase in intralenticular pressure and spontaneous tears in the capsulorhexis that extend to the periphery. When this occurs, the appearance of the stained blue anterior capsule beside the white cataract mimics the blue-white-blue pattern of the Argentinian flag and was named the Argentinian Flag Sign. Once this occurs, the remainder of the cataract extraction can become extremely difficult and can lead to many complications, such as posterior capsule rupture, vitreous loss, retained nucleus, and endothelial damage due to prolonged surgery time.

To prevent these complications we can use below methods.

1. Needle aspiration technique
2. Phacocapsulotomy technique

If u agree to participate in the study we will examine you for anterior segment and fundal changes .we will collect the treatment and relevant details about you from your hospital record. The information collected will be used only for research. This study will be reviewed by local ethical review board and will be started only after their formal approval. The care you will get will not change if you don't wish to participate. You are required to sign/provide thumb

impression only if you voluntarily agree to participate in this study. Participation in this study does not involve any cost for you. If any complication happens during above technique it will be treated free of cost. This also does not affect the care that you receive in the hospital.

I have read or have been read to me and understand the purpose of the study, the procedure that will be used, the risk and benefits associated with my involvement in the study and the nature of information that will be collected and disclosed during the study. I have had the opportunity to ask my questions regarding various aspects of the study and my questions are answered to my satisfaction. I the undersigned agree to participate in this study and authorize the collection and disclosure of my personal information for my research

Subject's name and signature /thumb impression Date:

Name and signature of witness/thumb impression Date:

Name and signature of person obtaining consent Date:

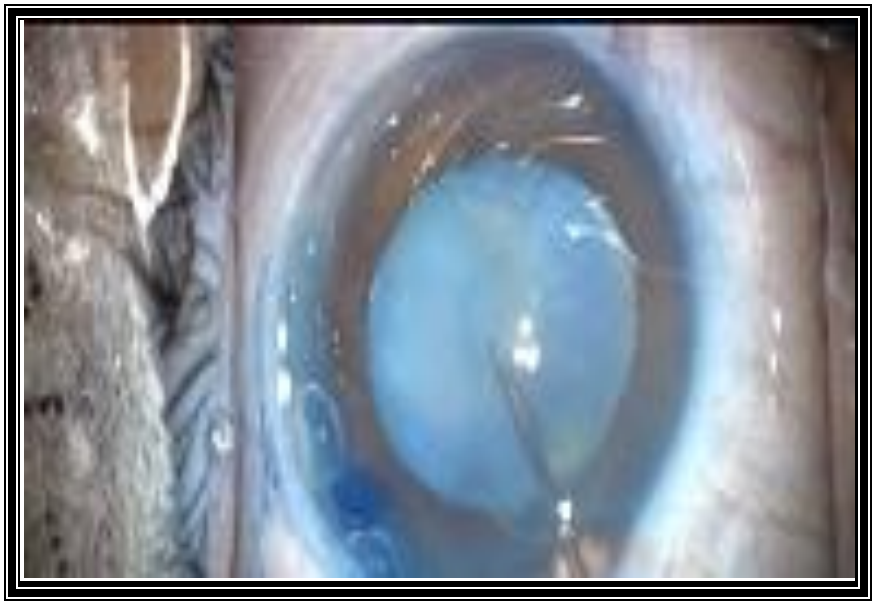
ANNEXURE III

PHOTOGRAPHS

PHOTOGRAPH 1: SLIT LAMP EXAMINATION

PHOTOGRAPH 2: PHACOEMULSIFICATION

PHOTOGRAPH 3: PHACOCAPSULOTOMY



PHOTOGRAPH 4: NEEDLE ASPIRATION

ANNEXURE IV

KEY TO MASTER CHART

Sl. No.: Serial number

IP.No.: Hospital number

KH: Keratometry reading in horizontal meridian

KV: Keratometry reading in horizontal meridian

AL: Axial length

IOL: Intraocular lens

RE : Right eye

LE : Left eye

UCDV: Uncorrected distant vision

UCNV: Uncorrected near vision

BCDV: Best corrected distant vision

BCNV: Best corrected near vision

Sl no	Names	Age	Sex	I.P.no	Diagnosis	Eye	KH	KV	AL	IOL	UCDV	UCNV	GROUP
1	MURUGAN	63	M	953536	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	45.25	43.00	22.61	23.50	CF1	N36	I
2	SUBANNA	57	M	943414	INTUMESCENT CATARACT(RE)PSP(LE)	RE	42.75	46.00	21.22	20.50	CF3	N18	I
3	VENKATESHAPPA	75	M	946693	INTUMESCENT CATARACT(RE)SIMC(LE)	RE	43.25	44.50	23.10	23.00	HM	N-	I
4	VENKATAMMA	70	F	946692	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	43.25	45.00	21.25	21.00	CF2	N36	I
5	NARAYANAPPA	55	F	946700	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	44.50	46.00	22.61	19.50	CF4	N12	I
6	GAURAMMA	85	F	949460	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	43.75	45.50	23.21	21.00	HM	N-	I
7	CHANDRAMMA	50	F	949457	INTUMESCENT CATARACT(LE) SIMC (RE)	LE	43.75	45.25	23.20	21.00	CF3	N18	I
8	GOWRAMMA	65	F	949469	INTUMESCENT CATARACT(RE) PSP(LE)	RE	42.25	48.50	21.91	25.00	CF4	N9	I
9	KADIRAMMA	65	F	949480	INTUMESCENT CATARACT(RE) PSP(LE)	RE	45.25	43.00	21.71	25.00	CF5	N18	I
10	NARAYANAPPA	65	M	956917	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	42.75	46.00	22.16	21.00	CF2	N24	I
11	NAGAPPA	65	M	956905	INTUMESCENT CATARACT(RE) PSP(LE)	RE	42.25	43.00	22.61	23.50	HM	N-	I
12	RAMANNA	75	M	962680	INTUMESCENT CATARACT(LE) SIMC (RE)	LE	42.00	46.50	21.22	20.50	CF3	N18	I
13	MAQBOOL UNNISA	70	M	962679	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	42.75	43.75	21.67	20.50	CF2	N12	I
14	JAYAMMA	70	F	963317	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	45.75	46.00	23.61	23.50	HM	N-	I
15	GANGAMMA	65	F	963319	INTUMESCENT CATARACT(RE) PSP(LE)	RE	43.00	42.00	20.00	19.50	CF1	N36	I
16	NARAYANASWAMY	65	M	963313	INTUMESCENT CATARACT(LE) SIMC (RE)	LE	43.00	44.25	21.76	19.00	CF4	N12	I
17	KITTAPPA	52	M	964629	INTUMESCENT CATARACT(LE) PSP(RE)	LE	45.00	45.75	21.74	21.50	CF3	N18	I
18	THIRUMANGALAMMA	50	F	965679	INTUMESCENT CATARACT(RE) PSP(LE)	RE	44.50	46.00	22.61	19.50	HM	N-	I
19	RAFIQ	53	M	965664	INTUMESCENT CATARACT(LE) PSP(RE)	LE	43.75	45.50	23.21	21.00	CF5	N12	I
20	NARAYANAMMA	85	F	965670	INTUMESCENT CATARACT(LE) PSP(RE)	LE	43.75	45.25	23.20	21.00	HM	N-	I
21	SRIRAMAPPA	62	M	966698	INTUMESCENT CATARACT(LE) PSP(RE)	LE	42.25	48.50	21.91	25.00	CF3	N18	I
22	VENKATAMMA	65	F	966701	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	45.25	43.00	21.71	25.00	CF4	N12	I
23	RAMAKKA	60	F	967439	INTUMESCENT CATARACT(LE) APHAKIA(RE)	LE	42.25	43.00	22.61	23.50	CF3	N18	I
24	LAKSHMAKKA	80	F	967447	INTUMESCENT CATARACT(RE) PSP(LE)	RE	42.00	46.50	21.22	20.50	CF4	N36	I
25	MUNIVENKATAPPA	67	M	970792	INTUMESCENT CATARACT(RE) PSP(LE)	RE	42.75	43.75	21.67	20.50	CF3	N18	I
26	VENKATAMMA	80	F	970790	INTUMESCENT CATARACT(RE)PSP(LE)	RE	45.75	46.00	23.61	23.50	CF2	N12	I
27	NARYANAGOWDA	80	M	972740	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	43.00	42.00	20.00	19.50	CF1	N36	I
28	MUNIYAMMA	58	F	972739	INTUMESCENT CATARACT(LE) SIMC (RE)	LE	44.50	46.00	23.21	21.00	HM	N-	I
29	VENKATESHAPPA	68	M	969579	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	43.75	45.50	22.61	19.50	CF5	N36	I
30	SRINIVASIAH	65	M	976537	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	43.50	45.50	23.21	21.00	HM	N-	I
31	NARAYANAMMA	70	F	978601	INTUMESCENT CATARACT(RE) PSP(LE)	RE	41.25	41.50	20.62	19.50	CF2	N24	I
32	MUNIYAMMA	60	F	979297	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	46.25	46.00	23.00	23.50	CF4	N36	I
33	ESHWARAPPA	60	F	979296	INTUMESCENT CATARACT(RE)PSP(LE)	RE	46.25	45.25	22.07	21.00	CF3	N18	I
34	MUNIVENKATAMMA	85	F	982833	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	43.00	44.25	22.73	20.50	CF1	N36	I
35	IRUMALLAPPA	70	M	982838	INTUMESCENT CATARACT(LE) PSP(RE)	LE	42.50	43.75	23.27	22.00	CF4	N18	I
36	GANGAMMA	60	F	983834	INTUMESCENT CATARACT(LE) PSP(RE)	LE	45.75	46.00	21.74	21.50	CF3	N12	I
37	BASAKKA	60	F	983536	INTUMESCENT CATARACT(LE) PSP(RE)	LE	44.25	44.25	23.03	20.50	HM	N-	I
38	NARAYANAMMA	80	F	983526	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	45.00	44.50	22.66	21.50	CF5	N36	I
39	CHOWDAMMA	65	F	984988	INTUMESCENT CATARACT(LE) SIMC (RE)	LE	43.25	45.00	21.56	22.50	HM	N-	I
40	MUNIYAMMA	74	F	987149	INTUMESCENT CATARACT(RE) PSP(LE)	RE	43.75	44.50	22.20	19.50	CF3	N18	I
41	SADAMMA	60	F	987216	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	45.75	43.75	22.55	22.00	CF4	N36	I
42	LAKSHMAMMA	54	F	987218	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	45.50	44.00	22.31	22.00	CF3	N18	I
43	GANGAMMA	64	F	990100	INTUMESCENT CATARACT(LE) SIMC (RE)	LE	45.50	44.00	22.57	22.00	CF4	N24	I
44	LAKSHMAMMA	70	F	990102	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	44.25	45.75	21.56	22.00	HM	N-	I
45	LAKSHMAKKA	55	F	990116	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	46.25	47.75	22.50	20.00	CF3	N36	I
46	NARAYANAPPA	70	M	992292	INTUMESCENT CATARACT(LE) SIMC (RE)	LE	42.50	47.00	23.56	20.00	CF4	N24	I
47	ESHWARAMMA	59	F	979233	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	44.50	46.00	22.61	19.50	CF5	N36	I
48	CHANNAPPA	67	M	994247	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	43.75	45.50	23.21	21.00	CF2	N9	I
49	VENKATARAMANAGOWDA	65	M	994261	INTUMESCENT CATARACT(LE) PSP(RE)	LE	43.00	44.25	21.76	19.00	CF2	N24	I
50	VENKATAMMA	70	F	996834	INTUMESCENT CATARACT(RE) PSP(LE)	RE	45.00	45.75	21.74	21.50	CF1	N36	I
51	VENKATARAMAIAH	70	M	997240	INTUMESCENT CATARACT(LE) PSP(RE)	LE	44.50	46.00	22.61	19.50	HM	N-	II
52	SHABEENA	57	F	1002171	INTUMESCENT CATARACT(RE) PSP(LE)	RE	43.75	45.50	23.21	21.00	CF5	N36	II
53	GANGAMMA	65	F	1002978	INTUMESCENT CATARACT(RE) PSP(LE)	RE	43.25	46.50	22.61	19.50	HM	N-	II
54	VANNAMMA	70	F	1002976	INTUMESCENT CATARACT(RE) PSP(LE)	RE	43.25	43.75	23.21	21.00	CF2	N18	II
55	AMEER JAAN	60	M	1002973	INTUMESCENT CATARACT(RE) PSP(LE)	RE	44.50	46.00	20.62	19.50	CF4	N36	II
56	GANGULAPPA	60	M	1008032	INTUMESCENT CATARACT(RE) PSP(LE)	RE	43.75	42.00	23.00	23.50	CF3	N12	II
57	NARAYANAMMA	70	F	1008086	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	43.75	44.25	22.07	21.00	CF1	N36	II
58	MUNIYAMMA	60	F	1008039	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	42.25	45.75	22.73	20.50	CF4	N9	II
59	MUNIVENKATAPPA	70	M	1009398	INTUMESCENT CATARACT(RE) PSP(LE)	RE	45.25	46.00	23.27	22.00	CF3	N36	II
60	VENKATAMMA	55	F	968834	INTUMESCENT CATARACT(LE) PSP(RE)	LE	44.50	45.50	21.74	21.50	HM	N-	II
61	RAMSINGH	51	M	876792	INTUMESCENT CATARACT(LE) PSP(RE)	LE	43.75	45.25	23.20	21.00	HM	N-	II
62	RADHAKRISHNAN	54	M	876794	INTUMESCENT CATARACT(LE) PSP(RE)	LE	42.25	48.50	21.91	25.00	CF3	N18	II
63	JAYAMMA	61	F	831148	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	45.25	43.00	21.71	25.00	CF4	N12	II
64	GOPAL KRISHNA	71	M	89146	INTUMESCENT CATARACT(LE) APHAKIA(RE)	LE	42.25	43.00	22.61	23.50	CF3	N18	II
65	JAYAMMA	74	F	895111	INTUMESCENT CATARACT(RE) PSP(LE)	RE	42.00	46.50	21.22	20.50	CF4	N36	II
66	BHARATHI	64	F	898392	INTUMESCENT CATARACT(RE) PSP(LE)	RE	42.75	43.75	21.67	20.50	CF3	N18	II
67	YELLOJI RAO	65	M	898997	INTUMESCENT CATARACT(RE)PSP(LE)	RE	45.75	46.00	23.61	23.50	CF2	N12	II
68	MUNIYAMMA	66	F	899242	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	43.00	42.00	20.00	19.50	CF1	N36	II
69	SHANTHABAI	52	F	579281	INTUMESCENT CATARACT(LE) SIMC (RE)	LE	44.50	46.00	23.21	21.00	HM	N-	II
70	LALITHA REDDY	55	M	791576	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	43.75	45.50	22.61	19.50	CF5	N36	II
71	GOPAL KRISHNA	68	M	891461	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	43.50	45.50	23.21	21.00	HM	N-	II

72	GANGAPPA	69	M	949606	INTUMESCENT CATARACT(RE) PSP(LE)	RE	41.25	41.50	20.62	19.50	CF2	N24	II
73	SRIDHAR	67	M	730628	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	46.25	46.00	23.00	23.50	CF4	N36	II
74	BASAMMA	53	F	725327	INTUMESCENT CATARACT(RE)PSP(LE)	RE	46.25	45.25	22.07	21.00	CF3	N18	II
75	VENKATARAMANAPPA	56	M	733234	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	43.00	44.25	22.73	20.50	CF1	N36	II
76	SHAKUNTALA	72	F	739673	INTUMESCENT CATARACT(LE) PSP(RE)	LE	42.50	43.75	23.27	22.00	CF4	N18	II
77	GOWRAMMA	73	F	739669	INTUMESCENT CATARACT(LE) PSP(RE)	LE	45.75	46.00	21.74	21.50	CF3	N12	II
78	BASHA	63	M	758909	INTUMESCENT CATARACT(LE) PSP(RE)	LE	44.25	44.25	23.03	20.50	HM	N-	II
79	ZAFURNNISA	62	F	760861	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	45.00	44.50	22.66	21.50	CF5	N36	II
80	VENKATACHALAPATHI	57	M	762809	INTUMESCENT CATARACT(LE) SIMC (RE)	LE	43.25	45.00	21.56	22.50	HM	N-	II
81	VENKATARAMANACHARI	63	M	780839	INTUMESCENT CATARACT(RE) PSP(LE)	RE	43.75	44.50	22.20	19.50	CF3	N18	II
82	NARAYANASWAMY	62	M	780810	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	45.75	43.75	22.55	22.00	CF4	N36	II
83	KITTAPPA	58	M	780845	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	45.50	44.00	22.31	22.00	CF3	N18	II
84	MUNIYAMMA	75	F	782147	INTUMESCENT CATARACT(LE) SIMC (RE)	LE	45.50	44.00	22.57	22.00	CF4	N24	II
85	MOOZAPPA	61	M	782162	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	44.25	45.75	21.56	22.00	HM	N-	II
86	SAROJAMMA	61	F	782136	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	46.25	47.75	22.50	20.00	CF3	N36	II
87	KRISHNAMMA	62	F	782152	INTUMESCENT CATARACT(LE) SIMC (RE)	LE	42.50	47.00	23.56	20.00	CF4	N24	II
88	NARAYANAPPA	65	M	782156	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	44.50	46.00	22.61	19.50	CF5	N36	II
89	MUNIVENKATAPPA	59	M	782154	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	43.75	45.50	23.21	21.00	CF2	N9	II
90	VENKATAGIRIYAPPA	76	M	782149	INTUMESCENT CATARACT(LE) PSP(RE)	LE	43.00	44.25	21.76	19.00	CF2	N24	II
91	VENKATASWAMY	64	M	782159	INTUMESCENT CATARACT(RE) PSP(LE)	RE	45.00	45.75	21.74	21.50	CF1	N36	II
92	SHAFUN BEE	66	F	782148	INTUMESCENT CATARACT(LE) PSP(RE)	LE	44.50	46.00	22.61	19.50	HM	N-	II
93	MARIYAPPA	60	M	782155	INTUMESCENT CATARACT(RE) PSP(LE)	RE	43.75	45.50	23.21	21.00	CF5	N36	II
94	SRIDEVI	77	F	794080	INTUMESCENT CATARACT(RE) PSP(LE)	RE	43.25	46.50	22.61	19.50	HM	N-	II
95	GANGAMMA	69	F	796088	INTUMESCENT CATARACT(RE) PSP(LE)	RE	43.25	43.75	23.21	21.00	CF2	N18	II
96	NANJAMMA	77	F	936028	INTUMESCENT CATARACT(RE) PSP(LE)	RE	44.50	46.00	20.62	19.50	CF4	N36	II
97	SHARADAMMA	76	F	937895	INTUMESCENT CATARACT(RE) PSP(LE)	RE	43.75	42.00	23.00	23.50	CF3	N12	II
98	NAGARAJ	68	M	938210	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	43.75	44.25	22.07	21.00	CF1	N36	II
99	NARAYANAMMA	67	F	939068	INTUMESCENT CATARACT(RE) SIMC (LE)	RE	42.25	45.75	22.73	20.50	CF4	N9	II
100	NARAYANASWAMY	70	M	948851	INTUMESCENT CATARACT(RE) PSP(LE)	RE	45.25	46.00	23.27	22.00	CF3	N36	II

POST OPERATIVE VISUAL ACUITY												
		Ist DAY		Ist WEEK		I st MONTH		3 rd MONTH		6th MONTH		
SL NO	NAMES	BC DV	BCNV	BCDV	BCNV	BCDV	BCNV	BCDV	BCNV	BCDV	BCNV	GROUP
1	MURUGAN	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	I
2	SUBANNA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	I
3	VENKATESHAPPA	6\24	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	I
4	VENKATAMMA	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	I
5	NARAYANAPPA	6\24	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	I
6	GAURAMMA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	I
7	CHANDRAMMA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	I
8	GOWRAMMA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	I
9	KADIRAMMA	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	I
10	NARAYANAPPA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	I
11	NAGAPPA	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	I
12	RAMANNA	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	I
13	MAQBOOL UNNISA	6\12	N6	6\12	N6	6\9	N6	6\9	N6	6\9	N6	I
14	JAYAMMA	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	I
15	GANGAMMA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	I
16	NARAYANASWAMY	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	I
17	KITTAPPA	6\18	N6	6\18	N6	6\9	N6	6\9	N6	6\9	N6	I
18	THIRUMANGALAMMA	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	I
19	RAFIQ	6\18	N6	6\18	N6	6\6	N6	6\6	N6	6\6	N6	I
20	NARAYANAMMA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	I
21	SRIRAMAPPA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	I
22	VENKATAMMA	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	I
23	RAMAKKA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	I
24	LAKSHMAKKA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	I
25	MUNIVENKATAPPA	6\12	N6	6\12	N6	6\12	N6	6\12	N6	6\12	N6	I
26	VENKATAMMA	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	I
27	NARYANAGOWDA	6\24	N6	6\24	N6	6\24	N6	6\24	N6	6\24	N6	I
28	MUNIYAMMA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	I
29	VENKATESHAPPA	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	I
30	SRINIVASIAH	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	I
31	NARAYANAMMA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	I
32	MUNIYAMMA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	I
33	ESHWARAPPA	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	I
34	MUNIVENKATAMMA	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	I
35	IRUMALLAPPA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	I
36	GANGAMMA	6\24	N6	6\18	N6	6\18	N6	6\18	N6	6\18	N6	I
37	BASAKKA	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	I
38	NARAYANAMMA	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	I
39	CHOWDAMMA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	I
40	MUNIYAMMA	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	I
41	SADAMMA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	I
42	LAKSHMAMMA	6\12	N6	6\12	N6	6\6	N6	6\6	N6	6\6	N6	I
43	GANGAMMA	6\12	N6	6\12	N6	6\12	N6	6\12	N6	6\12	N6	I
44	LAKSHMAMMA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	I
45	LAKSHMAKKA	6\12	N6	6\12	N6	6\12	N6	6\12	N6	6\12	N6	I
46	NARAYANAPPA	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	I
47	ESHWARAMMA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	I
48	CHANNAPPA	6\12	N6	6\12	N6	6\12	N6	6\12	N6	6\12	N6	I
49	VENKATARAMANAGOWDA	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	I
50	VENKATAMMA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	I
51	VENKATARAMAIAH	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	II
52	SHABEENA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	II
53	GANGAMMA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	II
54	VANNAMMA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	II
55	AMEER JAAN	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	II
56	GANGULAPPA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	II
57	NARAYANAMMA	6\24	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	II
58	MUNIYAMMA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	II
59	MUNIVENKATAPPA	6\24	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	II
60	VENKATAMMA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	II
61	RAMSINGH	6\12	N6	6\12	N6	6\6	N6	6\6	N6	6\6	N6	II
62	RADHAKRISHNAN	6\24	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	II

63	JAYAMMA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	II
64	GOPAL KRISHNA	6\12	N6	6\12	N6	6\6	N6	6\6	N6	6\6	N6	II
65	JAYAMMA	6\24	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	II
66	BHARATHI	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	II
67	YELLOJI RAO	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	II
68	MUNIYAMMA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	II
69	SHANTHABAI	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	II
70	LALITHA REDDY	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	II
71	GOPAL KRISHNA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	II
72	GANGAPPA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	II
73	SRIDHAR	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	II
74	BASAMMA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	II
75	VENKATARAMANAPPA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	II
76	SHAKUNTALA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	II
77	GOWRAMMA	6\6	N6	6\6	N6	6\6	N6	6\6	N6	6\6	N6	II
78	BASHA	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	II
79	ZAFURNNISA	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	II
80	VENKATACHALAPATHI	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	II
81	VENKATARAMANACHARI	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	II
82	NARAYANASWAMY	6\12	N6	6\12	N6	6\12	N6	6\12	N6	6\12	N6	II
83	KITTAPPA	6\24	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	II
84	MUNIYAMMA	6\12	N6	6\12	N6	6\12	N6	6\12	N6	6\12	N6	II
85	MOOZAPPA	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	II
86	SAROJAMMA	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	II
87	KRISHNAMMA	6\12	N6	6\12	N6	6\12	N6	6\12	N6	6\12	N6	II
88	NARAYANAPPA	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	II
89	MUNIVENKATAPPA	6\12	N6	6\12	N6	6\9	N6	6\9	N6	6\9	N6	II
90	VENKATAGIRIYAPPA	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	II
91	VENKATASWAMY	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	II
92	SHAFUN BEE	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	II
93	MARIYAPPA	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	II
94	SRIDEVI	6\12	N6	6\12	N6	6\12	N6	6\12	N6	6\12	N6	II
95	GANGAMMA	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	II
96	NANJAMMA	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	II
97	SHARADAMMA	6\12	N6	6\12	N6	6\12	N6	6\12	N6	6\12	N6	II
98	NAGARAJ	6\9	N6	6\9	N6	6\9	N6	6\9	N6	6\9	N6	II
99	NARAYANAMMA	6\12	N6	6\12	N6	6\12	N6	6\12	N6	6\12	N6	II
100	NARAYANASWAMY	6\24	N6	6\24	N6	6\24	N6	6\24	N6	6\24	N6	II

COMPLICATIONS										
		INTRAOPERATIVE					POSTOPERATIVE			
SL NO	NAMES	EXTENSION INTO PERIPHERY	CENTRATION OF CAPSULORHEXIS	DECREASE IN INTRALENTICULAR PRESSURE	POSTERIOR CAPSULE RUPTURE	VITREOUS LOSS	CORNEAL EDEMA	RISE IN IOP	IRITIS	GROUP
1	MURUGAN	-	+	+	-	-	-	-	-	I
2	SUBANNA	-	+	+	-	-	-	-	-	I
3	VENKATESHAPPA	-	+	+	-	-	-	-	-	I
4	VENKATAMMA	-	+	+	-	-	-	-	-	I
5	NARAYANAPPA	-	-	+	-	-	-	-	-	I
6	GAURAMMA	-	+	+	-	-	+	-	+	I
7	CHANDRAMMA	-	+	-	-	-	-	-	-	I
8	GOWRAMMA	-	+	+	-	-	-	-	-	I
9	KADIRAMMA	-	+	+	-	-	-	-	-	I
10	NARAYANAPPA	-	+	+	-	-	-	+	-	I
11	NAGAPPA	-	+	+	-	-	-	-	-	I
12	RAMANNA	-	+	+	-	-	-	-	-	I
13	MAQBOOL UNNISA	-	-	+	-	-	-	-	-	I
14	JAYAMMA	-	+	+	-	-	-	-	-	I
15	GANGAMMA	-	-	-	-	-	-	-	-	I
16	NARAYANASWAMY	-	+	+	-	-	-	-	-	I
17	KITTAPPA	-	+	+	-	-	-	-	-	I
18	THIRUMANGALAMMA	-	+	-	-	-	-	-	+	I
19	RAFIQ	-	+	+	-	-	-	-	-	I
20	NARAYANAMMA	-	+	+	-	-	-	-	-	I
21	SRIRAMAPPA	-	+	+	-	-	+	-	+	I
22	VENKATAMMA	-	+	+	-	-	-	-	-	I
23	RAMAKKA	-	+	+	-	-	-	-	-	I
24	LAKSHMAKKA	-	-	+	-	-	-	-	-	I
25	MUNIVENKATAPPA	-	+	+	-	-	-	-	-	I
26	VENKATAMMA	-	+	+	-	-	-	-	-	I
27	NARYANAGOWDA	-	+	+	-	-	-	-	-	I
28	MUNIYAMMA	-	+	+	-	-	-	-	-	I
29	VENKATESHAPPA	-	+	+	-	-	-	+	-	I
30	SRINIVASIAH	+	+	+	+	-	-	-	-	I
31	NARAYANAMMA	-	+	+	-	-	-	-	-	I
32	MUNIYAMMA	-	-	-	-	-	-	-	-	I
33	ESHWARAPPA	-	+	+	-	-	-	-	-	I
34	MUNIVENKATAMMA	-	+	+	-	-	-	-	-	I
35	IRUMALLAPPA	-	+	+	-	-	-	-	-	I

36	GANGAMMA	-	+	+	-	-	-	-	-	I
37	BASAKKA	-	+	+	-	-	-	-	-	I
38	NARAYANAMMA	-	+	+	-	-	-	-	-	I
39	CHOWDAMMA	-	+	+	-	-	-	-	-	I
40	MUNIYAMMA	-	+	+	-	-	-	-	-	I
41	SADAMMA	-	+	+	*	-	-	-	-	I
42	LAKSHMAMMA	-	+	+	-	-	+	-	+	I
43	GANGAMMA	-	+	-	-	-	-	-	-	I
44	LAKSHMAMMA	-	+	+	-	-	-	-	-	I
45	LAKSHMAKKA	-	+	+	-	-	-	-	-	I
46	NARAYANAPPA	-	-	+	-	-	-	-	-	I
47	ESHWARAMMA	-	+	+	-	-	-	-	-	I
48	CHANNAPPA	-	+	+	-	-	-	-	-	II
49	ENKATARAMANAGOWI	-	+	-	-	-	-	-	-	II
50	VENKATAMMA	-	+	+	-	-	-	-	-	II
51	VENKATARAMAIAH	-	+	+	-	-	-	-	-	II
52	SHABEENA	+	+	+	+	-	-	-	-	II
53	GANGAMMA	-	+	+	-	-	-	-	-	II
54	VANNAMMA	-	+	+	-	-	-	-	-	II
55	AMEER JAAN	-	-	-	-	-	+	-	-	II
56	GANGULAPPA	-	+	+	-	-	-	-	-	II
57	NARAYANAMMA	-	+	+	-	-	-	-	-	II
58	MUNIYAMMA	-	+	+	-	-	-	-	+	II
59	MUNIVENKATAPPA	-	-	+	-	-	-	-	-	II
60	VENKATAMMA	-	+	-	-	-	-	-	-	II
61	RAMSINGH	+	+	+	+	-	+	-	+	II
62	RADHAKRISHNAN	-	+	+	-	-	-	-	-	II
63	JAYAMMA	-	+	+	-	-	-	-	-	II
64	GOPAL KRISHNA	-	+	+	-	-	-	-	-	II
65	JAYAMMA	-	+	+	-	-	-	-	-	II
66	BHARATHI	-	-	+	-	-	-	-	-	II
67	YELLOJI RAO	+	+	+	-	-	-	-	-	II
68	MUNIYAMMA	-	+	-	-	-	-	-	-	II
69	SHANTHABAI	-	-	+	-	-	-	-	-	II
70	LALITHA REDDY	-	+	+	-	-	-	-	-	II
71	GOPAL KRISHNA	-	+	+	-	-	-	-	+	II
72	GANGAPPA	-	+	+	-	-	-	-	-	II
73	SRIDHAR	-	+	-	-	-	-	-	-	II

74	BASAMMA	-	+	+	-	-	-	+	-	II
75	VENKATARAMANAPPA	-	+	+	-	-	-	-	-	II
76	SHAKUNTALA	-	-	+	-	-	-	-	-	II
77	GOWRAMMA	-	+	+	-	-	-	-	-	II
78	BASHA	-	+	+	-	-	+	-	+	II
79	ZAFURNNISA	-	+	+	-	-	-	-	-	II
80	VENKATACHALAPATHI	-	+	-	-	-	+	+	+	II
81	VENKATARAMANACHA	-	+	+	-	-	-	-	-	II
82	NARAYANASWAMY	+	-	+	+	+	-	-	-	II
83	KITTAPPA	-	+	+	-	-	-	-	-	II
84	MUNIYAMMA	-	+	+	-	-	-	-	-	II
85	MOOZAPPA	-	+	+	-	-	-	-	-	II
86	SAROJAMMA	+	-	+	-	-	-	-	-	II
87	KRISHNAMMA	-	+	+	-	-	-	-	-	II
88	NARAYANAPPA	-	+	+	-	-	-	-	-	II
89	MUNIVENKATAPPA	-	+	+	-	-	-	-	-	II
90	VENKATAGIRIYAPPA	+	+	+	-	-	-	-	-	II
91	VENKATASWAMY	-	+	-	-	-	-	+	-	II
92	SHAFUN BEE	-	-	+	-	-	-	-	-	II
93	MARIYAPPA	-	+	+	-	-	-	-	-	II
94	SRIDEVI	-	+	+	-	-	-	-	-	II
95	GANGAMMA	-	+	-	-	-	-	-	-	II
96	NANJAMMA	+	-	+	-	-	+	-	+	II
97	SHARADAMMA	-	+	+	-	-	-	-	-	II
98	NAGARAJ	-	+	-	-	-	-	-	-	II
99	NARAYANAMMA	-	+	+	-	-	-	+	-	II
100	NARAYANASWAMY	-	+	-	-	-	-	-	-	II