A Dissertation on

A STUDY ON ANALYSIS OF THE SURGICAL OUTCOMES IN CONGENITAL GLAUCOMA FOLLOWING COMBINED TRABECULOTOMY AND TRABECULECTOMY

Submitted in partial fulfillment of requirements of

M. S. OPHTHALMOLOGY

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CERTIFICATE

This is to certify that **Dr.R.ANANDHI,** Post Graduate student in M.S Ophthalmology, at Regional Institute of Ophthalmology and Government Ophthalmic hospital attached to Madras Medical College, Chennai, carried out this dissertation on "**ANALYSIS OF THE SURGICAL OUTCOMES IN CONGENITAL GLAUCOMA FOLLOWING COMBINED TRABECULOTOMY AND TRABECULECTOMY"** under our direct guidance and supervision during the academic period from May 2017 to April 2020.

This dissertation is submitted to the TamilNadu Dr.MGR Medical University, Chennai for the fulfillment of award of M.S. Degree in Ophthalmology.

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DECLARATION

I, **Dr.R.ANANDHI,** solemnly declare that the dissertation titled **"ANALYSIS OF THE SURGICAL OUTCOMES IN CONGENITAL GLAUCOMA FOLLOWING COMBINED TRABECULOTOMY AND TRABECULECTOMY"** has been prepared by me. This is submitted to The Tamil Nadu Dr.M.G.R. Medical University, Chennai, in partial fulfillment of the requirement for the award of M.S. Ophthalmology (Branch - III), degree Examination to be held in May 2020.

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This is to certify that this dissertation work titled **"ANALYSIS OF THE SURGICAL OUTCOMES IN CONGENITAL GLAUCOMA FOLLOWING COMBINED TRABECULOTOMY AND TRABECULECTOMY"** of the candidate **Dr. R. ANANDHI** for the award of **M.S., DEGREE** BRANCH-III (OPHTHALMOLOGY). I personally verified the urkund.com website for the purpose of plagiarism check. I found that the uploaded thesis file contains from introduction to conclusion pages and result shows **3(three)** percentage of plagiarism in the dissertation.

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CONTENTS

INTRODUCTION

Terminologies used to represent raised intraocular pressure in children.

Developmental glaucoma

It refers to glaucoma associated with developmental anomalies of eye present at birth. It includes congenital glaucoma and glaucoma associated with other developmental anomalies, either systemic or ocular. In all forms it occurs in about 1 in 10,000 live births.

Isolated congenital glaucoma

It refers to a special form of glaucoma. These eyes have an isolated maldevelopment of trabecular meshwork not associated with other developmental ocular anomalies or ocular disease that can raise intra ocular pressure. Isolated congenital glaucoma is the most common glaucoma of infancy, occurring in 1 in 30,000 live births.

Buphthalmos or Hydrophthalmia

Buphthalmos is derived from a Greek word “ox eye” and refers to marked enlargement that can occur as a result of any type of glaucoma present in infancy. Hydrophthalmia refers to the high fluid content present with marked enlargement of an eye, which can occur in any type of glaucoma during infancy.

THEORIES OF ABNORMAL DEVELOPMENT

Von Muralt	1869	Described congenital glaucoma as one belonging to the glaucoma
Collins	1896	Abnormal mesodermal tissue in the angle
Mann	1928	Incomplete atrophy of anterior chamber mesoderm
Barkan	1955	Incomplete resorption of mesodermal cells leading to membrane formation
Allen	1955	Incomplete cleavage of mesoderm
Maumenee	1959	Abnormal anterior insertion of ciliary muscle into trabecular meshwork.
Anderson	1981	Histopathological proof that the iris and ciliary body have appearance of eye in 7th month of gestation rather than one which is at full term development.

HISTORICAL REVIEW OF SURGICAL PROCEDURES

Carlo De Vincentis	**1893**	Performed Goniotomy without visualizing angle structures.
Otto Barkan	**1938**	Perfected Goniotomy using specially designed glass contact lens to visualize angle structures.
Burian and Smith	**1960**	Performed Trabeculotomy ab externa.

NORMAL DEVELOPMENT OF THE ANTERIOR CHAMBER ANGLE

Anterior surface of the iris meets the corneal endothelium at five months of gestation to form the peripheral aspect of anterior chamber.

Slightly posterior to this junction are cells forming the developing trabecular meshwork. The ciliary muscle and ciliary process overlap the trabecular meshwork, being separated by loose connective tissue.

The trabecular meshwork later becomes exposed to anterior chamber as the angle recess deepens and moves posteriorly. The iris insertion into the angle wall is rather flat, as the angle recess has not yet formed. Posterior sliding of the uveal tissue continues during the first 6 to 12 months of life which is apparent gonioscopically as formation of the angle recess. The adult angle configuration, in which the iris turns slightly posteriorly before inserting into the ciliary body, is not normally present at birth but develops in the first 6 to 12 months of life.

EMBRYOLOGY

16 – 18 weeks: Development of scleral spur begins

Mesenchymal cells of trabecular meshwork secrete collagen and elastic tissue.

Juxtacanalicular region differentiates.

Vacuoles configuration present in endothelial lining of Schlemm's canal.

21 – 23 weeks: Angle recess at level of schlemm's canal

Trabecular meshwork consists of outer corneoscleral portion and inner uveal portion.

Corneoscleral meshwork organized as trabecular beams and inter trabecular spaces is formed.

28 – 30 weeks: Longitudinal fibres of ciliary muscle distinct and inserts into scleral spur.

Uveal meshwork shows wide intercellular space.

35 – 39 weeks: Angle recess reaches level of scleral spur.

NORMAL ANTERIOR CHAMBER ANGLE

On gonioscopy of a normal new born eye, the insertion of the iris into the angle wall is seen posterior to the scleral spur. The anterior extension of ciliary body is seen as a band anterior to iris insertion.

ANTERIOR CHAMBER IN CONGENITAL GLAUCOMA

Histological abnormalities found on examination of trabecular meshwork includes thickening of trabecular beams, thickened cords of uveal meshwork and compression of meshwork with a resultant reduction in trabecular spaces. Appearance of a membrane was due to observation of thickened compact trabecular beams in the area of meshwork adjacent to anterior chamber.

Schlemm's canal is open in early stages of congenital glaucoma. It may be obliterated in advanced stages but this is believed to be a secondary alteration from the effect of raised intra ocular pressure on ocular tissues. A thickening of juxtacanalicular connective tissue and an amorphous material in the sub endothelial area of internal wall of Schlemm's canal has been noted.

INHERITANCE

Majority of cases are sporadic

10% autosomal recessive with variable penetrance

Infantile glaucoma gene-2p21

Polygenic inheritance

CLASSIFICATION OF CONGENITAL GLAUCOMA

SHAFFER WIESS CLASSIFICATION

1. Isolated Congenital Glaucoma (Or) Primary congenital open angle glaucoma

2. Glaucomas associated with congenital s anomalies

    1. Aniridia
    2. Sturge Weber syndrome
    3. Neurofibromatosis
    4. Marfans syndrome
    5. Homocystinuria
    6. Lowe’s syndrome
    7. Broad thumb syndrome
    8. Microcornea
    9. Microspherophakia
    10. Persistent Hyperplastic Primary Vitreous
    11. Pierre Robin syndrome
    12. Goniodysgenesis
    13. Chromosomal abnormalities

3. Acquired glaucoma (or) secondary glaucoma

a. Retrolental fibroplasia

b. Tumors—retinoblastoma, neuroblastoma

c. Inflammation— uveitis, keratitis, rubella

d. Post traumatic

HOSKINS ANATOMIC CLASSIFICATION

1. Isolated trabeculodysgenesis- Maldevelopment of trabecular meshwork.

    a. Flat iris insertion

        1. anterior insertion

        2. posterior insertion

        3. mixed insertion

    b. Concave iris insertion

2. Iridotrabeculodysgenesis

    a. Anterior stromal defects-hyperplasia/hypoplasia

    b. Anomalous iris vessels-persistent tunica vasculosa, anomalous superior vessels.

    c. Structural anomalies-holes, coloboma, aniridia

3. Corneotrabeculodysgenesis

    a. Peripheral

    b. Midperipheral

c. Central

d. Microcornea / megalocornea

GLAUCOMA ASSOCIATED WITH CONGENITAL OCULAR ABNORMALITIES

Axenfeld-Rieger syndrome

Hypoplasia/hyperplasia of iris

Peter’s anomaly

Congenital ectropion uveae

Congenital corneal staphyloma

Cornea plana

Iridoschisis

Megalocornea

Morning glory syndrome

Nanophthalmos

GLAUCOMAS ASSOCIATED WITH SYSTEMIC CONGENITAL ABNORMALITIES

Weil-Marchesani syndrome

Mucopolysaccharidoses

Hallermann-Streiff syndrome

Cerebrohepatorenal syndrome (Zellweger syndrome)

Prader-Willi syndrome

Cystinosis

Oculodentodigital dysplasia

Fetal alcohol syndrome

Waardenburg syndrome

Cockayne syndrome

Stickler syndrome

RACE

No racial predilection exists.

No sex predilection exists in aniridia, Axenfeld-Rieger syndrome, Peter's anomaly, or phakomatoses.

Lowe syndrome, one of the causes of secondary congenital glaucoma, has X-linked transmission and appears in males

PATHOPHYSIOLOGY

The embryologic basis of all developmental glaucoma is fetal maldevelopment of the iridocorneal angle, called **goniodysgenesis.**

TRABECULODYSGENESIS

Maldevelopment of the trabecular meshwork

IRIDOTRABECULODYSGENESIS

It is the maldevelopment of the iris anterior stroma, the iris vessels or the full iris thickness.

CORNEOTRABECULODYSGENESIS

It is the maldevelopment of the cornea which include peripheral, mid peripheral and central defects as well as microcornea and megalocornea. Peripheral corneal lesions occur adjacent to and concentric with the limbus and extend no more than 2 mm into clear cornea. These usually involve entire corneal circumference and are most often seen as posterior embryotoxon with adherent iris tissue (Axenfeld's anomaly). Mid peripheral lesions are generally found with Rieger's anomaly.

These may occur singly or in combination. Isolated Trabeculodysgenesis is the hallmark of primary developmental

glaucoma. Barkan assumed that a thin membrane covered the anterior chamber angle preventing aqueous outflow. However electron microscopic studies provided no evidence of membrane in any of the specimens. Based on clinical and histopathological observations the mechanism of developmental glaucoma has been attributed to a developmental arrest, late in gestation, of certain anterior segment structures derived from neural crest cells (Angularneurocristopathies).

High intraocular pressure causes corneal clouding, rapid enlargement of the globe and limbal stretching. The corneal diameter can enlarge up to 17mm. There may be stretching of the Descemet's membrane, resulting in linear ruptures (Haab's striae) which can lead to corneal stromal and epithelial edema as well as corneal scarring if the problem is chronic.

Sclera also expands slowly under the influence of increased IOP. The associated scleral thinning brings about visibility of the underlying uveal tissue in neonates and causes the sclera to appear blue. Thus in advanced stages the eye expands in all dimensions resembling an Ox eye (Buphthalmos).

The optic nerve head in children is more vulnerable to increased intra ocular pressure, and in advanced stages, the disc may show complete

cupping. However, optic disc cupping may be reversible with normalization of intra ocular pressure particularly in the early stage.

CLINICAL PRESENTATION

The classic **triad** of manifestation includes:

Epiphora

Photophobia

Blepharospasm

These symptoms are due to corneal irritation that accompanies corneal epithelial edema caused by elevated intra ocular pressure. Baby keeps eyes closed when exposed to light. In severe cases, the child may become irritable to the point of burying his or her head in a pillow to avoid the pain of photophobia Clouding of the cornea with or without enlargement of globe occurs. Major enlargement occurs at corneoscleral junction. As the axial length increases, myopia and astigmatism occur. Pain is unusual in older children with primary developmental glaucoma.

EXAMINATION

DIAGNOSTIC EXAMINATION

Examination under general anaesthesia (EUA) is advisable for all children who do not cooperate in an office examination.

Equipments required to perform a basic EUA

1) Pediatric speculum
2) Balanced salt solution
3) Tonometer (hand held Icare Rebound Tonometer)
4) Direct ophthalmoscope
5) Retinoscope
6) Koeppe or Goldmann Goniolens & light source
7) Calipers
8) Slit lamp
9) Ultrasound
10) Fundus camera

EXTERNAL EXAMINATION

The most common cause of Epiphora in the new born is blocked nasolacrimal duct (CNLDO). It is differentiated in that mucopurulent discharge is present in CNLDO.

CORNEAL ASSESSMENT

The cornea is examined to document the presence or absence of breaks in Descemet's membrane (Haab's **striae)** and corneal enlargement in order to distinguish the glaucomatous signs from other corneal abnormalities. Other causes of hazy cornea must be ruled out. These include

1) Sclero cornea
2) Tears in Descemet's membrane (obstetrical trauma)
3) Corneal ulcers
4) Metabolic diseases: Mucopolysaccharidoses & mucolipidosis
5) Peter's anomaly
6) Corneal dystrophies
7) Central corneal dermoid

A corneal diameter more than 12 mm before the age of 1is indicative of PCG. Enlargement of the cornea in PCG basically occurs until the age of 3, but the sclera can undergo stretching upto the age of 10. Separate measurements of the corneal diameters are to be taken in both the horizontal and vertical meridians.

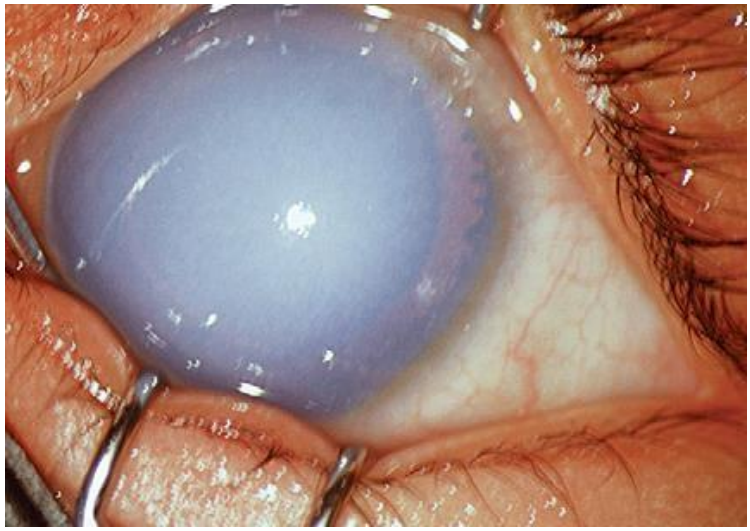
Calipers should be used for the measurement.

Age	Corneal diameters (mm)	
	Normal	Possible Glaucoma
Newborns	9.5–10.5	11.5–12.0
1 year	10–11.5	12.0–12.5
2 years	11.5–12	12.5–13.0
3 years	12	13.0–14.0

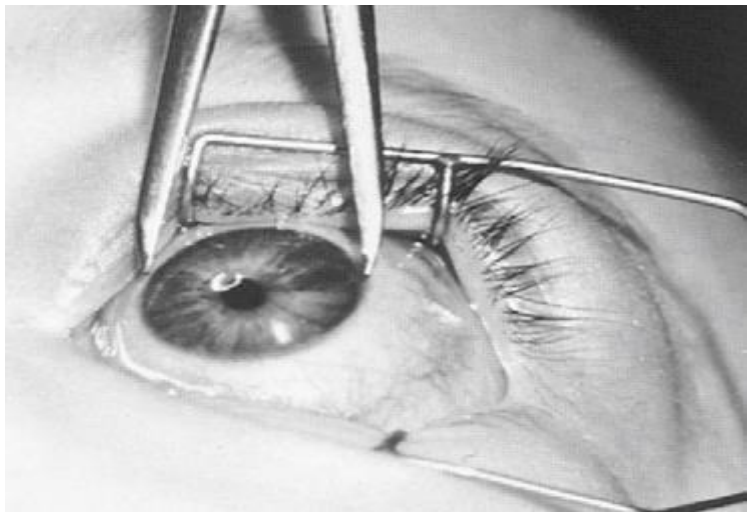
a. Edema of the cornea in PCG starts at the epithelial level due to raised IOP which eventually results in permanent stromal edema. If not treated promptly, the edema worsens leading to permanent scarring of the stroma and thus increases the astigmatic index.

b. The acute elevation of IOP results in damage to the corneal endothelium and stretching of the Descemet's membrane leading to breaks in these layers[30]. Since this was first described by Haab, these striae are named after him. These striae are typically horizontal and linear when they occur centrally in the cornea, but parallel or curvilinear to the limbus when they occur peripherally.

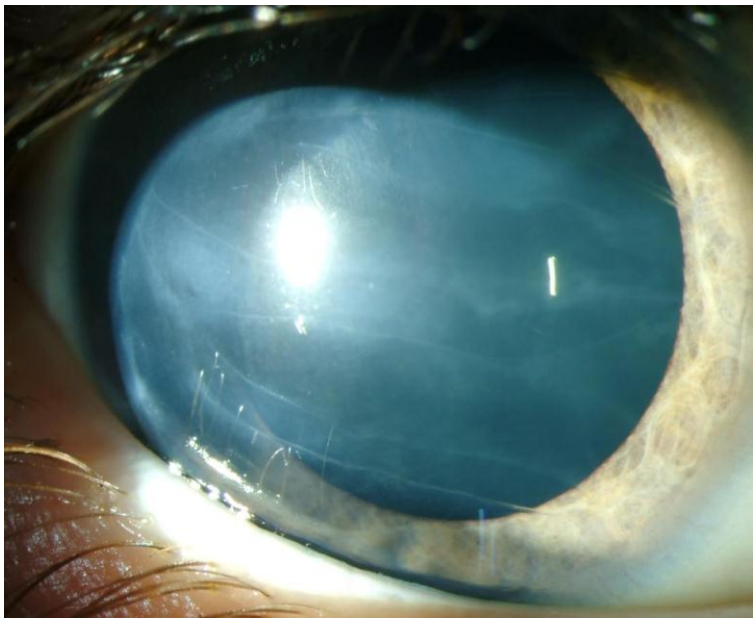
(Fig 1) Corneal edema in a case of congenital glaucoma



(Fig 2) Measurement of corneal diameter using calipers



(Fig 3) Haab's Striae



Direct Gonioscopic lenses used in infants (Fig 4) Richardson-Shaffer lens (L) is a miniature of Koeppe lens (R)

REFRACTION

Determination of refractive errors is done with streak retinoscopy if media is clear.

While myopia is the commonest refractive error in congenital glaucoma, its magnitude does not reach the expected value because the final refraction is influenced by

1) More flattened cornea (eyeball growth & corneal growth cause it’s flattening)

2) Flattening of lens (scleral ring adjacent to the ciliary body increases in diameter – stretching of zonules – decrease in lens thickness)

3) Deep anterior chamber due to backward positioning of lens.

All these factors contribute to **emmetropisation**.

TONOMETRY

Intra ocular pressure (IOP) should be measured with a Icare Rebound Tonometer or Perkins hand held applanation tonometer. In case of scarred and edematous cornea Mackay Marg tonometer is considered the most accurate.

All anesthetics agents alter IOP in the plane of anesthesia and as a direct effect on the cardiovascular tonus. A rapid lowering of IOP occurs with Halothane and readings 15-20 mm below the true measurements can be obtained.

Role of Ketamine: Recent studies show that ketamine given after premedication with diazepam and Meperidine does not raise IOP and intramuscular Ketamine even lowers IOP in children.

Standardization of anesthesia for IOP measurement for diagnosis and follow up is desirable and inconsistent reading should always be

interpreted considering the patient's general stage of anesthesia and the specific anesthetic used.

Normal IOP in an infant under Halothane anesthesia is 9-10 mm Hg. IOP more than 20mm Hg indicates glaucoma. The most reliable method of measuring IOP is probably with child awake and Perkins tonometer has been found to be particularly suitable.

SLIT LAMP EXAMINATION OR EXAMINATION UNDER MICROSCOPE

This is done with a portable hand held slit lamp or binocular operating microscope.

Descemet's breaks are seen in the cornea.

Anterior chamber is characteristically deep

Iris is usually normal although it may have stromal hypoplasia with loss of crypts.

GONIOSCOPY

The Koeppe lens provides the surgeon with the appropriate view of the angle. If corneal clouding is marked, it could preclude a view of the angle. In the normal newborn eye, iris inserts posterior to the scleral spur. Trabecular meshwork appears more translucent than that of the adult. In primary congenital glaucoma the angle is usually open angle with high insertion of iris root. Iris is inserted anterior to scleral spur. The surface of trabecular meshwork may have a stippled appearance and the meshwork may be thicker than normal.

Loops of vessels from major arterial circle may be seen above iris root – **"Loch Ness monster phenomenon"**.

Peripheral iris covered by fine, fluffy tissue- **"Lister's morning mist".**

OPHTHALMOSCOPY

Cup Disc (CD) ratio greater than 0.3 or asymmetry are suggestive of developmental glaucoma. The infant glaucomatous cup is more commonly round, steep walled and central and the cup tends to enlarge circumferentially with the progression of glaucoma.

Other optic nerve head abnormalities to be ruled out are

1) Congenital malformations of the disc

2) Coloboma

3) Optic disc pit

4) Hypoplasia

5) Tilted disc of axial myopia

6) Large physiologic cup

ULTRASONOGRAPHY

Normal axial length in an infant is 17.5-20mm and increases to 22mm by 1 year. Axial length may decrease up to 0.8mm following surgical reduction of IOP.

FACTORS INFLUENCING THERAPEUTIC DECISIONS

The choice of therapy in developmental glaucoma depends on a variety of factors. The most important of these is the structural defect associated with the elevated IOP. In addition, age, corneal clarity and associated systemic syndromes can influence the choice of therapy.

A) STRUCTURAL DEFECTS

Isolated trabeculodysgenesis

It is highly responsive to goniotomy and trabeculotomy ab externa.

Irido-Trabeculodysgenesis

When other defects are associated with trabeculodysgenesis the success rate of monotony and / or Trabeculotomy is lowered. In iridodysgenesis, where the only iris defect is hypoplasia of the anterior stroma, good response to surgery has been reported.

However, when the iris defect is abnormal, vessels appear to wander irregularly across the surface of the iris, and the prognosis is extremely grave. In such cases, multiple surgeries are usually needed.

Iridocorneal dysgenesis

In patients with Axenfeld – Rieger's anomaly, surgical therapy does not have good prognosis and medical therapy is used initially. Often medical therapy too is unsuccessful, therefore, surgical intervention become necessary. In such cases, surgery should be tailored to the specific cause.

B) AGE

In general, children under the age of 3 years are best treated surgically. Children over 3 years of age deserve a trial of medical therapy unless specific defect of trabeculodysgenesis is seen.

C) CORNEAL CLARITY

In situations, where corneal clouding prevents adequate visualization of the trabecular meshwork, goniotomy is impossible. Trabeculotomy ab externa has to be performed as the initial procedure.

D) CORNEAL DIAMETER

Eyes with corneal diameter greater than 15 mm are not suitable for goniotomy. Trabeculotomy with trabeculectomy should be performed as the initial procedure.

E) SEVERITY OF GLAUCOMA

In advanced cases of developmental glaucoma, ab externo combined trabeculotomy with trabeculectomy should be done as it offers the highest success rate in such a situation.

MEDICAL THERAPY

Congenital glaucoma is essentially a surgical disease. Medical therapy has a supportive role to reduce the IOP temporarily, to clear the cornea and to facilitate surgical intervention.

CARBONIC ANHYDRASE INHIBITOR

Acetazolamide either alone or in combination with miotics, in a oral dose of 10-15mgs of body weight every 6 hours is safe and well tolerated by infants. It lowers IOP and reduces corneal edema as preclude to surgery. Side effects are rare.

BETA BLOCKERS

Timolol is the most commonly used medication for treatment of developmental glaucoma. It is a non selective β1 and β2 adrenergic blocker that reduces IOP by reducing aqueous inflow. Selective β blockers like betaxolol may be safer than timolol in children with asthma.

MIOTICS

Pilocarpine may be used at 1 to 2% concentration topically every 6 to 8 hours but topical application of miotics is not very effective because of the abnormal insertion of the ciliary muscle into trabecular meshwork.

SURGICAL THERAPY

GONIOTOMY

After the introduction of clinical Gonioscopy, Otto Barkan in1938 modified the Carlo Devincentis operation by using a specially designed glass contact lens to visualize the angle structures while using a knife to create an internal cleft in the trabecular tissue.

The objective of goniotomy is to incise the obstructing tissue that causes the retention of aqueous and thereby restore the access of aqueous to Schlemm's canal, thus maintaining the physiological direction of the flow. Goniotomy is most successful in the patients in whom glaucoma is recognized early and treated between 1 month and 1 year of age.

COMPLICATIONS

Hyphaema,

Iridodialysis

Cyclodialysis

Peripheral anterior synechiae

Damage to the lens

RD in high myopic eyes

TRABECULOTOMY AB EXTERNO

A fornix-based or limbus-based conjunctival flap is made, followed by a partial thickness scleral flap as it is done in trabeculectomy, and Schlemm's canal is then deroofed by incising midway between the anterior bluish-gray area and the posterior white scleral area.

The lower arm of the Haams' trabeculotome is introduced into the canal using the upper parallel arm as a guide. Once 90% of the trabeculotome is within the canal, it is rotated into the anterior chamber. Rotation of the trabeculotome is continued until 75% of the probe arm length has entered the chamber, then the rotation is reversed and the instrument is withdrawn. About 2 to 2 1 / 2 clock hours of the internal wall of Schlemm's canal and trabecular meshwork are disrupted by the rotation of the trabeculotome into the anterior chamber. The trabeculotomes then passed into the Schlemm's canal on the other side of the radial incision and rotated into the anterior chamber.

In total, about 100 to 120 degrees of trabecular meshwork is ruptured by this technique.

This establishes direct contact between the anterior chamber and

schlemm's canal. Scleral flap must be sutured tightly with 10-0 nylon and the conjunctival flap with 8-0 vicryl. Various studies have proved that trabeculotomy outstands goniotomy, as the initial procedure however in few studies both the procedures faired equally well.

Trabeculotomy ab externo has a lot of advantages over Goniotomy[38].

1. It can even be done in edematous or scarred cornea.
2. Breakthrough of the inner wall of the Schlemm's canal and trabecular meshwork can be more accurate.
3. Sharp instruments need not be introduced into the AC.
4. Can be performed under operating microscope thus it precludes the need for special gonioscopic lens.
5. Can be repeated
6. Can be converted to trabeculectomy if needed
7. Can be combined with trabeculectomy to achieve better results

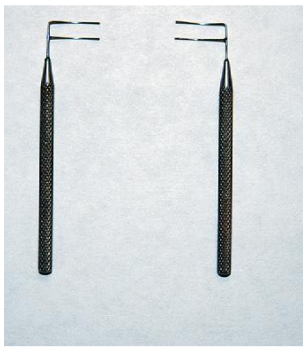
Disadvantages of Trabeculotomy includes

1. Damage to the conjunctiva can interfere with the outcome of future filtering surgery
2. Special trabeculotomy probes are needed
3. Altered limbal anatomy especially in severe cases of buphthalmos makes the identification of sclemm's canal difficult

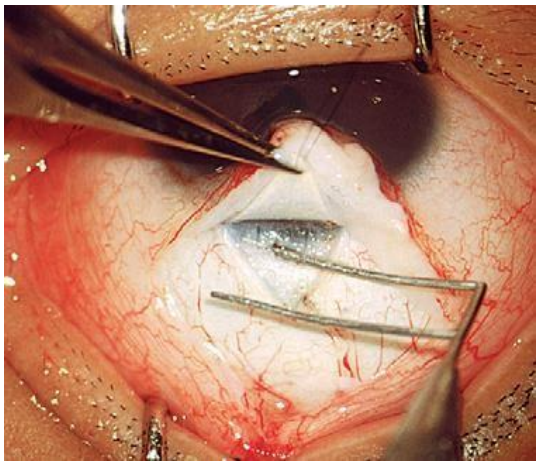
4. Schlemm’s canal is not found in 4 to 20 % of the cases
5. Conversion of trabeculotomy entry site to trabeculectomy makes the sclerostomy site very close to the root of iris which predisposes to iris tissue incarceration
6. Undesirable external filtration can occur

Anomalous angle type is found to be the only factor influencing the success of trabeculotomy ab externo. However, the success of Goniotomy relies upon the stage of glaucoma, corneal diameter or the presence or absence of hazy cornea. Studies have proved that goniotomy is successful in about 64–77% of eyes, while trabeculotomy controls IOP in over 90% of eyes. However, no prospective, controlled trials are available to compare the success rate of both the procedures in the same study.

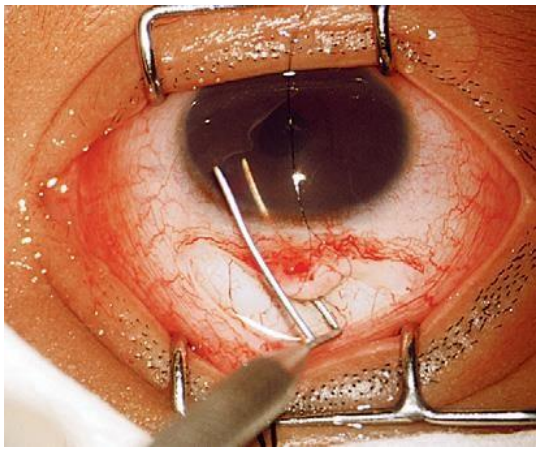
(Fig 5) The Haams’ trabeculotomes



(Fig 6) The trabeculotome is passed into Schlemm's canal



(Fig 7) The trabeculotome is rotated into the anterior chamber



It can be used even when corneal haze prevents an adequate gonioscopic view which is a prerequisite for performing goniotomy. This involves cannulating Schlemm's canal with a nylon suture at one site and threading the suture circumferentially, then withdrawing it at another site and pulling it tight like a bow string.

TRABECULECTOMY WITH TRABECULOTOMY

The trabeculotomy is performed to remove the possible obstruction to the aqueous outflow while the trabeculectomy is included to bypass the episcleral venous system. It is the procedure of choice when exact mechanism of glaucoma is uncertain. Mitomycin C increases success rate of trabeculectomy when used with caution

COMPLICATIONS

Bleb Failure

Hyphaema,

Tears in Descemets membrane,

False passage in to anterior chamber or supra choroidal space

Iridodialysis

Cyclodialysis.

Peripheral anterior synechiae.

Injury to lens

Staphyloma

AQUEOUS SHUNTING PROCEDURES

Device is made of non-reactive synthetic material to which fibroblast adheres poorly. The bleb is placed away from the anterior limbus to reduce inflammation and thinning.

Pediatric Molteno implants (8mm in diameter) and baby Baerveldt implants are specifically designed for this purpose.

COMPLICATIONS

Hypotony

Tube endothelial touch

Erosion of tube

Migration of tube

Cataract formation

CYCLODESTRUCTIVE PROCEDURES

If the IOP is unduly high, rate of aqueous production is reduced by injuring the ciliary processes preferably by Cyclocryotherapy, or Nd-YAG laser transscleral photocoagulation.

TREATMENT OF COMPLICATIONS

Persistent corneal clouding after reduction of IOP is treated by PKP Occlusion therapy is done in case of amblyopia.

LONG TERM FOLLOW UP

Between 3 to 6 weeks after surgery the post operative control of the glaucoma must be judged. The degree of relief from photophobia, tearing and blepharospasm usually reflect the effectiveness of surgery and may reasonably predict whether additional surgery is required.

Each follow up evaluation include :

Visual acuity testing

External examination

Appearance of the filtering bleb

Corneal assessment

Ophthalmoscopy

Refraction

Gonioscopy

Tonometry

Ultrasound biometry.

VISUAL REHABILITATION

Visual rehabilitation is as important in the management of the disease as is the control of IOP. Visual rehabilitation involves correction of refractive errors, correction of opacities in the media such as corneal scarring and cataract, and orthoptic treatment to stimulate the development of binocular stereoscopic vision. Anisometropia and amblyopia must be aggressively treated to give good vision in both eyes. These should be undertaken as early as possible.

REVIEW OF LITERATURE

1. OUTCOMES OF SURGERY FOR PRIMARY CONGENITAL GLAUCOMA IN KENYA: A MULTICENTRE RETROSPECTIVE CASE SERIES

Jalikatu Mustapha, KARIMURIO Jefitha, MARCO Sheila, MUNDIA Daniel

AIM : To assess the efficacy and outcomes of the surgical procedures for primary congenital glaucoma thus facilitating evidence-based practice in the management of Primary Congenital Glaucoma.

METHODS: This was a retrospective case series conducted in 4 tertiary hospitals in Kenya. Eyes of children <16 years of age who were operated for PCG from 2005 to 2014, were followed up to a maximum of 2 years. Post-operative IOP was the primary outcome measure. Surgical success and complication rates were calculated for each type of surgery. Kaplan Meier (KM) survivor curves were used to assess the cumulative probability of surgical success.

RESULTS: Majority of primary surgeries were trabeculectomies (TET- 40.8%) and combined trabeculectomy-trabeculotomies (CTT- 38%). Qualified success was obtained in 73.3% of eyes and complete success in 23% of eyes. KM probability of success at 1 month, 3 months, 6 months, 1 year and 2 years were 95%, 86%, 81%, 76% and 71% respectively.

The only significant predictor of surgical failure was a large pre-operative cup disc ratio (CDR). There was no change in the mean number of glaucoma drugs used between pre- and post-operative period. In India, a success rate of 75.5% was reported at 1year follow up for CTT alone, even in eyes with advanced disease.

Conclusion: The most frequently-performed surgical procedures for PCG are TET and CTT. Surgical intervention was successful up to a period of 2 years post-operatively. CTT and AGV achieved the highest rates of surgical success as primary procedures. A large pre-operative CDR was a risk factor for surgical failure.

2. Surgical results of combined trabeculotomy-trabeculectomy for developmental glaucoma.

Mandal AK[1], Naduvilath TJ, Jayagandan A.

OBJECTIVE:

The purpose of the study was to evaluate the surgical outcome of combined trabeculotomy-trabeculectomy in different types of primary developmental glaucomas.

DESIGN:

A retrospective review of all cases of primary developmental glaucomas that underwent primary combined trabeculotomy-trabeculectomy with a minimum follow-up of 6 months, was performed.

PARTICIPANTS:

One hundred and eighty-two eyes of 120 patients were included in this study; 122 (67%) eyes had congenital glaucoma; 22 (12.1%) eyes had infantile glaucoma; and 38 (20.9%) eyes had juvenile glaucoma.

INTERVENTION:

Primary combined trabeculotomy-trabeculectomy was the chosen intervention.

MAIN OUTCOME MEASURES:

Preoperative and postoperative intraocular pressures, visual acuities, success rate, corneal clarity and diameters, bleb characteristics, time of

surgical failure, and complications were the main outcome measures.

RESULTS:

Intraocular pressure (mean +/- SD) reduced from a preoperative level of 26.5 +/- 8.3 mmHg; 30.3 +/- 9.9 mmHg; and 31.8 +/- 11.5 mmHg to 13.1 +/- 5.8 mmHg; 13.7 +/- 4.4 mmHg; and 13.3 +/- 6.0 mmHg in the congenital, infantile, and juvenile types of developmental glaucomas, respectively. Kaplan-Meier survival analysis showed that the success probability at 6 months was 94.4% +/- 2.3%; 90.9% +/- 6.1%; and 81.0% +/- 7.3% in the three groups, respectively. The success probability of patients with juvenile glaucoma was significantly lower than it was for those with congenital glaucoma ($P = 0.0393$). Of 182 eyes, 105 (57.7%) eyes had corneal edema at presentation. Eighty-one (79%) of 105 eyes had complete clearance of corneal edema postoperatively ($P < 0.0001$). The follow-up period ranged from 6 months to 48 months (mean, 10.7 +/- 12.0 months). There were no sight-threatening intraoperative and postoperative complications in any patient.

CONCLUSIONS:

Primary combined trabeculotomy-trabeculectomy is safe, effective, and sufficiently predictable to be considered the first choice of surgical treatment in primary congenital glaucoma with corneal edema. Juvenile glaucoma has the worst prognosis, and infantile glaucoma has a better prognosis than does juvenile glaucoma.

AIM OF THE STUDY

To analyse the outcomes in congenital glaucoma following combined trabeculotomy and trabeculectomy and to determine the intraocular pressure control following surgery.

Primary objective : To determine intraocular pressure control following combined trabeculotomy and trabeculectomy.

Secondary objective : To analyse other factors that determine the outcomes following combined trabeculotomy and trabeculectomy surgery like

1) Clinical evaluation of primary congenital glaucoma
2) Success of combined trabeculotomy and trabeculectomy defined as

- **Complete success :** IOP >5mmHg and <21mmHg without glaucoma medications or further glaucoma surgery.
- **Qualified success :** IOP >5mmHg and <21mmHg with glaucoma medications or further glaucoma surgery.
- **Failure :** includes
    - IOP ≤5mmHg or ≥21mmHg at the last visit
    - Need for additional glaucoma surgeries

MATERIALS AND METHODS

Design of study :

Prospective study

Study Population :

30 eyes of 15 patients

All bilateral presentation

STUDY CENTRE:

Regional Institute of Ophthalmology and Government

Ophthalmic Hospital, Chennai

SUBJECT SELECTION:

Inclusion Criteria*:*

Pediatric patients with the following criteria will be included in the study

1. Increased corneal diameter (>12.0 mm),
2. Raised intraocular pressure (>21 mmHg) and/ or presence of Haab's striae,
3. Optic disc changes (where examination was possible).
4. Symptoms of epiphora and photophobia were the additional inclusion factors.
5. Onset since birth
6. Patients previously diagnosed to have Primary Congenital Glaucoma and on treatment will be included.

Exclusion Criteria*:*

1. Patients Association with any systemic and /or ocular anomalies
2. Developmental Glaucoma
3. Secondary glaucoma acquired due to birth trauma or ocular neoplasm

METHODOLOGY

This is a prospective study conducted in Regional Institute of Ophthalmology, Government Ophthalmic Hospital, Chennai during the period of June to December 2018.

30 eyes of 15 patients were included in the study. Since all patients included in the study had primary congenital glaucoma, all patients had bilateral presentation. Children who were not cooperative for office examination were examined under anesthesia.

Parameters that were recorded included:

1) Age of presentation
2) Sex of the individual
3) History of consanguinity
4) Vision
5) Under anesthesia intra ocular pressure was recorded using Icare Rebound tonometer. Corneal diameter was measured using Castroviejo calipers. Fundus examination was done using direct ophthalmoscopy

After diagnosing congenital glaucoma, patients who were with elevated IOP and high risk for surgery under general anesthesia were all initially started with medical management.

Surgeries were done once patients obtained GA fitness. All the surgeries were done by a single experienced surgeon.

All eyes were started with medical therapy.

Adequate control of intraocular pressure is achieved before surgery to avoid intra operative complications.

Then all eyes underwent combined Trabeculotomy and Trabeculectomy surgery.

Right eyes were operated first followed by the Left eyes whenever the patients had similar severity bilaterally for study purpose.

Post operatively corneal clarity was assessed. Repeat intra ocular measurements were done on follow up.

Patients were assessed the success of surgery as mentioned.

Patients were followed up and refractive errors were corrected and spectacles were prescribed if possible. Cases with amblyopia were started on occlusion therapy.

RESULTS

1. AGE DISTRIBUTION

Table 1 : Age Distribution of Patients

Variable	Obs	Mean	Std. Dev.
Age in Months	15	6.07	3.33

In our study , the mean age of presentation of the patients were Six months (Mean 6.07 months).

2. LATERALITY

Table 2 : Laterality of Eyes

LATERALITY	Percent
Bilateral	100
Unilateral	0
Total	100

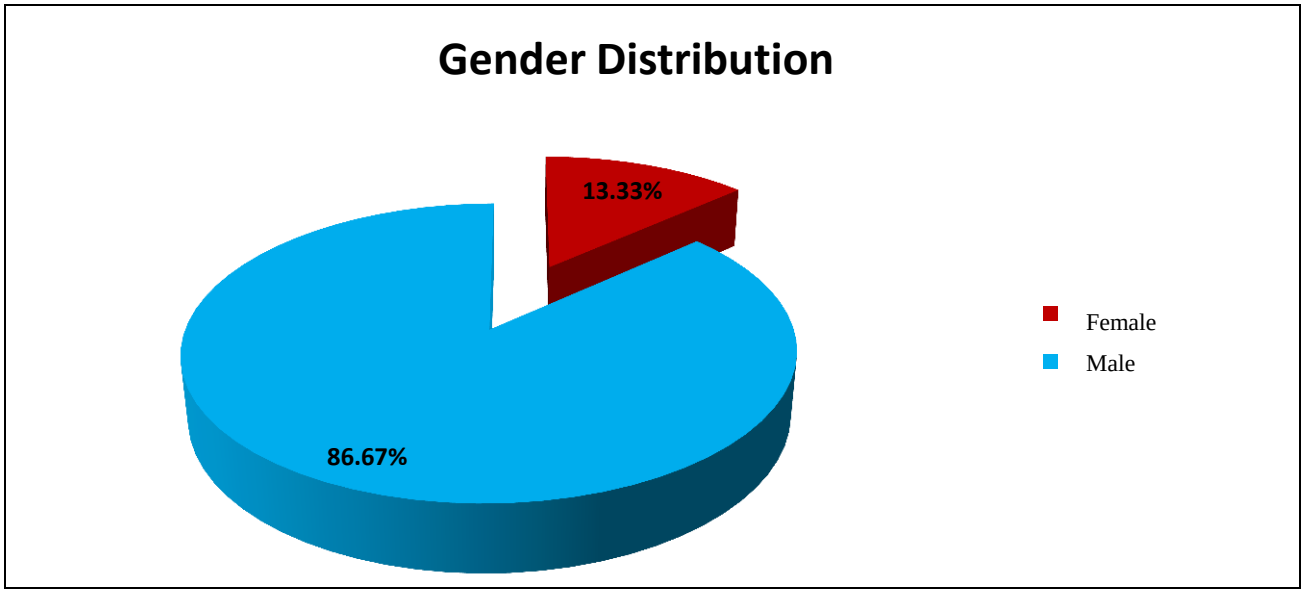
All patients in this study had bilateral presentation since all patients Included were Primary Congenital Glaucoma with no associated secondary Ocular or systemic involvement.

3. GENDER DISTRIBUTION

Table 3 : Gender Distribution of Patients

Gender	Frequency	Percentage
Female	2	13.33
Male	13	86.67
Total	15	100

Chart 3 : Gender Distribution of Patients



In this study male children were more commonly affected which constituted about 86.67% of cases.

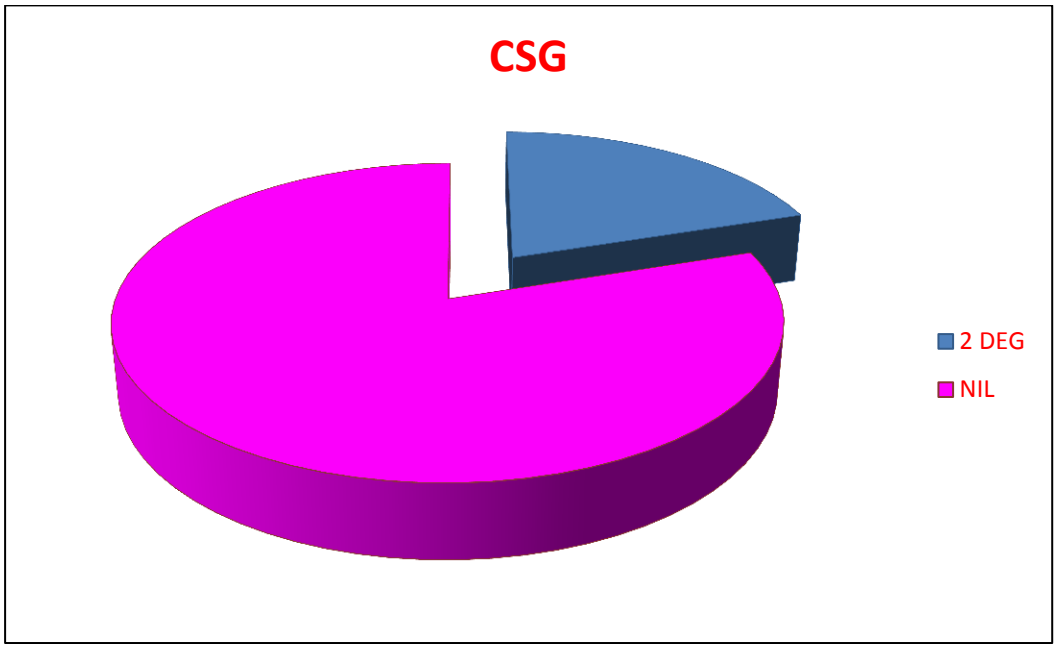
BIRTH HISTORY

4. CONSANGUINITY

Table 4 : Consanguinity of Parents

CONSANGUINITY	FREQ.	PERCENT
2nd DEGREE	3	20
NIL	12	80
Total	15	100

Chart 4 : Consanguinity of Parents



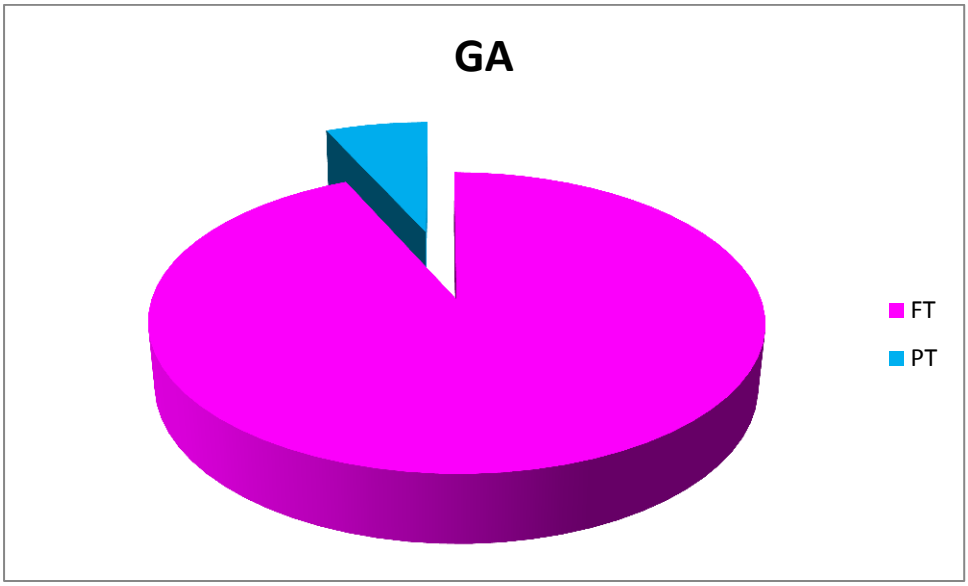
Most of the children (80%)in this study were born of non consanguinous marriage.

5. GESTATIONAL AGE :

Table 5 : Gestational Age Of Patients

GA	FREQ.	PERCENT
FT	14	93.33
PT	1	6.67
Total	15	100

Chart 5 : Gestational Age Of Patients



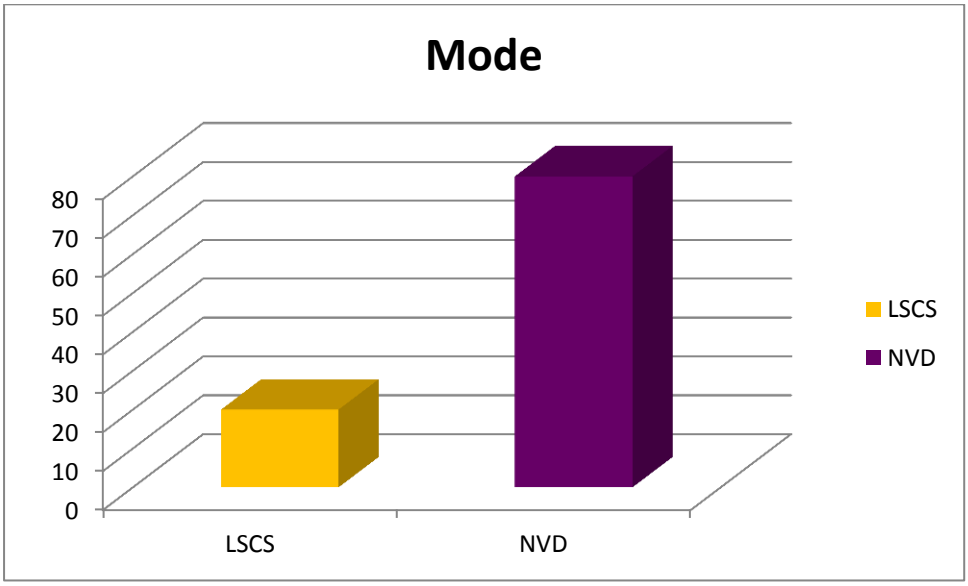
In this study, majority (93.33 %) of patients were born at full term .

6. MODE OF DELIVERY

Table 6 : Mode of Delivery of Patients

MODE	FREQ.	PERCENT
LSCS	3	20
NVD	12	80
Total	15	100

Chart 6 : Mode of Delivery of Patients



In this study, majority 80 % were born out of uncomplicated Normal Vaginal Delivery without birth trauma.

7. VISION AT PRESENTATION :

Table 7 : Right Eye Vision at Presentation of Patients

RE VISION	FREQ.	PERCENT
FF	11	91.67
M	1	8.33
Total	12	100

Chart 7 : Right Eye Vision at Presentation of Patients

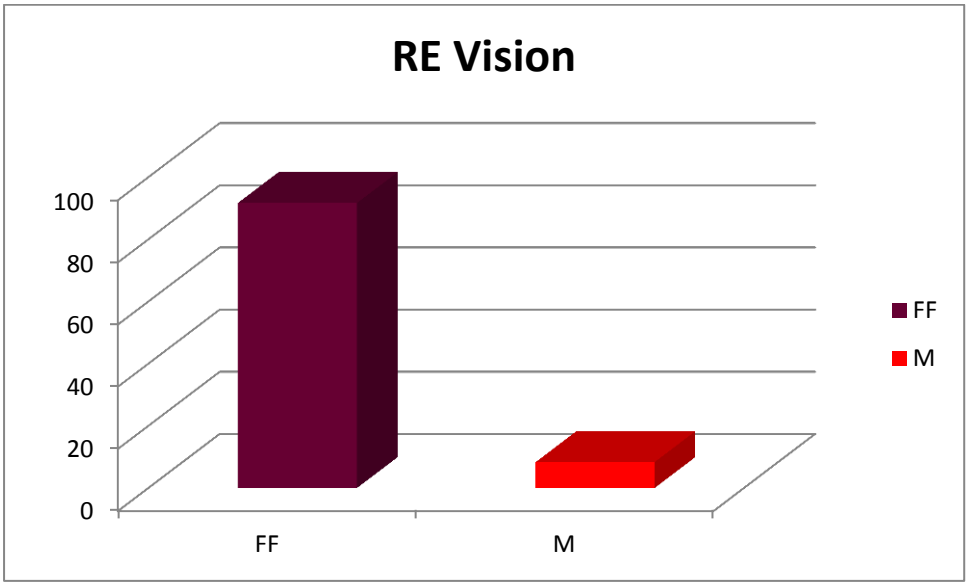
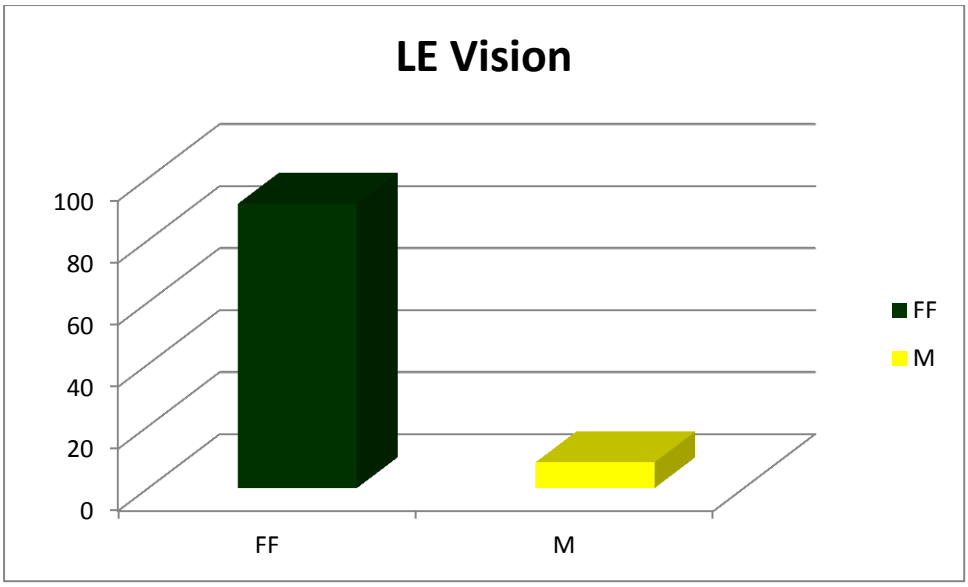


Table 8 : Left Eye Vision at Presentation of Patients

LE VISION	FREQ.	PERCENT
FF	11	91.67
M	1	8.33
Total	12	100

Chart 8 : Left Eye Vision at Presentation of Patients



In this study, majority 91.67 % of patients were able to demonstrate vision of only Fixing and Following Light. Whereas 8.33 % of patients had Myopic Refraction status. Visual Acquity was not recorded for 6 eyes.

8. CORNEA STATUS AT PRESENTATION :

Table 9 : Status of Cornea at Presentation

RIGHT EYE

CORNEA RE	FREQ.	PERCENT
HS	4	26.67
MH	2	13.33
MH,HS	1	6.67
SH	7	46.67
SH,HS	1	6.67
Total	15	100

Chart 9 : Status of Cornea at Presentation

RIGHT EYE

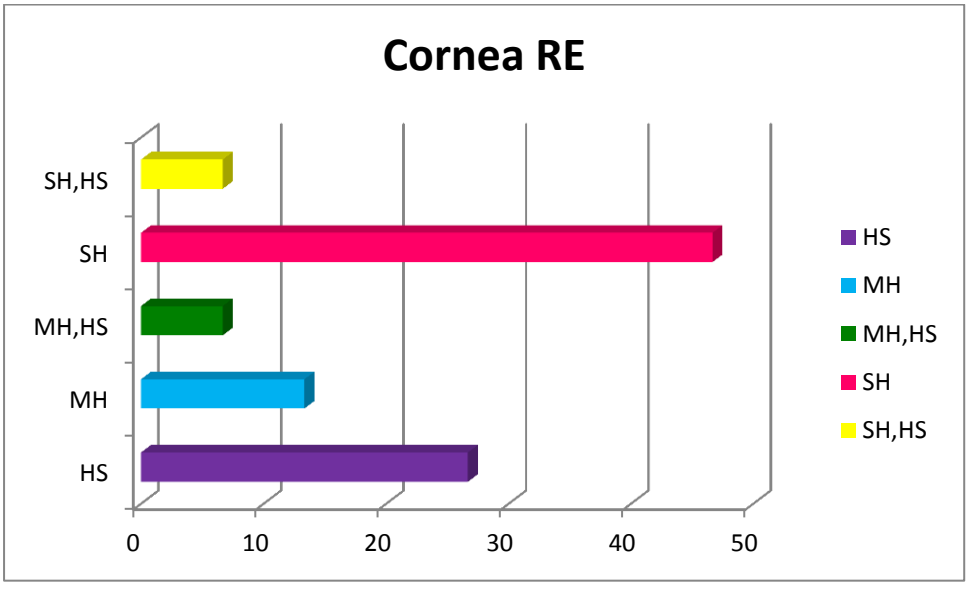


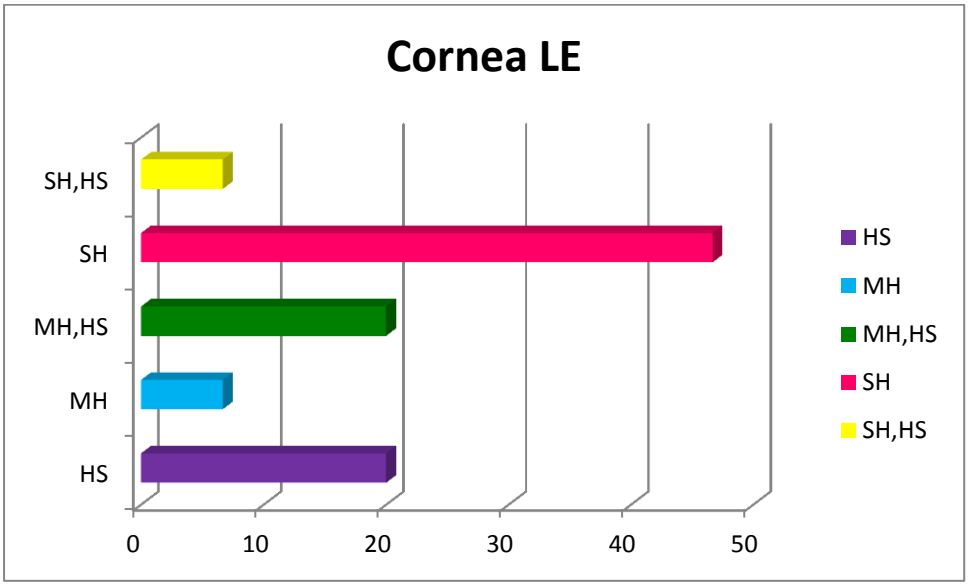
Table 10 : Status of Cornea at Presentation

LEFT EYE

CORNEA LE	FREQ.	PERCENT
HS	3	20
MH	1	6.67
MH,HS	3	20
SH	7	46.67
SH,HS	1	6.67
Total	15	100

Chart 10 : Status of Cornea at Presentation

LEFT EYE



In our study, 7 cases (46.67%) showed bilaterally severe Haze of cornea, 1 case showed bilaterally severe Haze with Haab's Striae whereas other eyes showed varying presentation of mild Haze with or without Haab's striae.

9. CORNEAL DIAMETER :

Table 11 : Corneal Diameter at Presentation
RIGHT EYE

VARIABLE	OBS	MEAN	STD. DEV.
RE Corneal Horizontal Diameter	15	12.40	0.99
RE Corneal Vertical Diameter	15	12.37	0.93

Chart 11 : Corneal Diameter at Presentation
Right eye

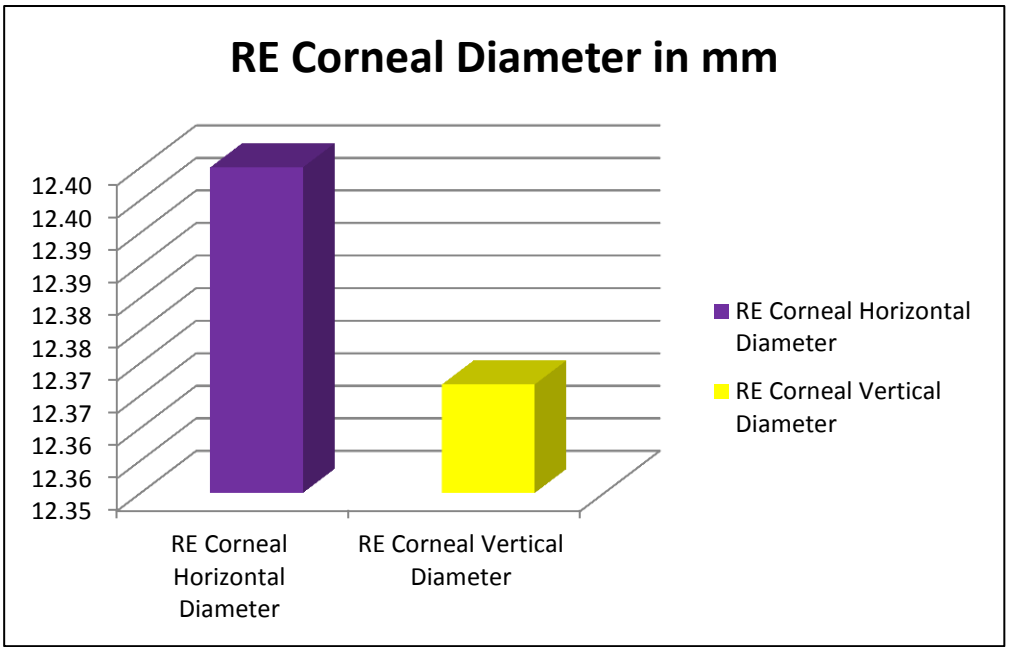
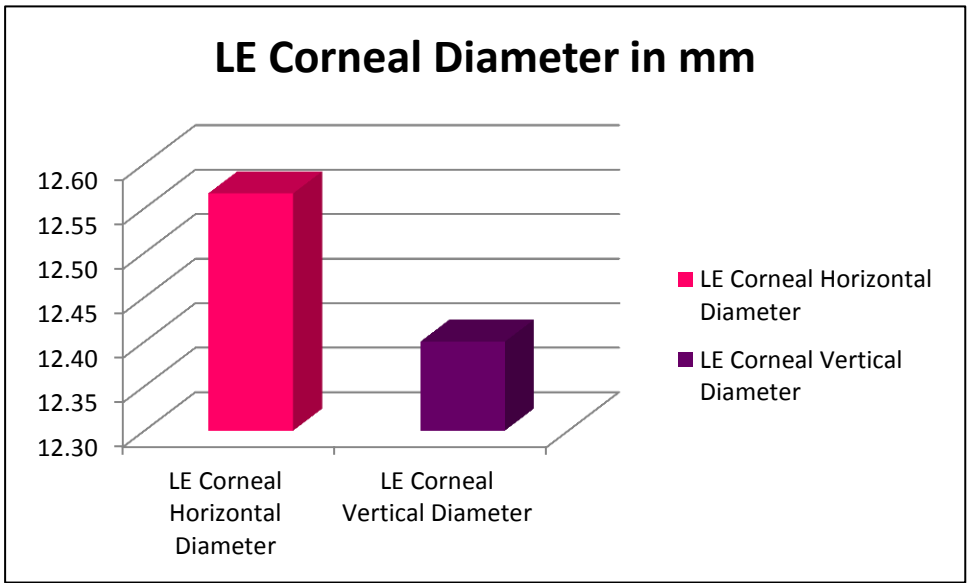


Table 12 : Corneal Diameter at Presentation

LEFT EYE

VARIABLE	OBS	MEAN	STD. DEV.
LE Corneal Horizontal Diameter	15	12.57	0.80
LE Corneal Vertical Diameter	15	12.40	1.06

Chart 12 : Corneal Diameter at Presentation
LEFT EYE



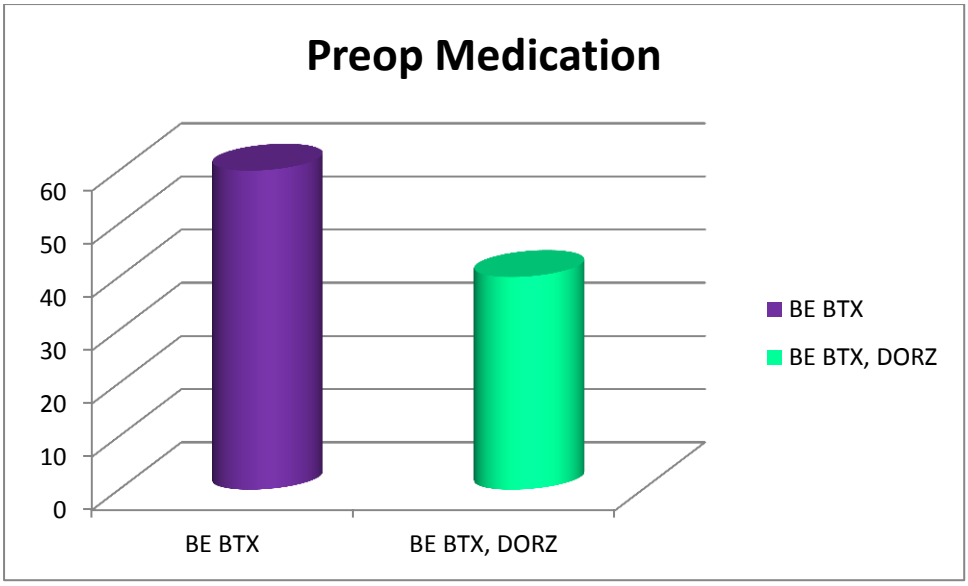
In this study, the mean horizontal diameter was 12.40 mm and 12.57 mm respectively for right eye and left eye. Whereas the vertical diameter was 12.37 and 12.40 mm respectively.

10. PRE OPERATIVE MEDICATIONS NEEDED :

Table 13 : NUMBER OF PRE OPERATIVE MEDICATIONS NEEDED

MEDICATIONS	FREQ.	PERCENT
BE BTX (One medication)	18	60
BE BTX, DORZ (Two medications)	12	40
Total	30	100

Chart 13 : NUMBER OF PRE OPERATIVE MEDICATIONS NEEDED



In our study, 18 eyes 60% of patients needed one medication of the Beta Blocker Group to control IOP whereas 12 eyes 40% of patients needed two medication – One Beta Blocker and one Carbonic Anhydrase Inhibitor additionally to control IOP.

FOLLOW UP

11. VISION AT 6 MONTHS POST OPERATIVE :

Table 14 : Vision at 6 months of Post Operative Period

RIGHT EYE

RE VISION – MONTH 6 POST OP	FREQ.	PERCENT
FF	11	73.33
M	4	26.67
Total	15	100

Chart 14 : Vision at 6 months of Post Operative Period

RIGHT EYE

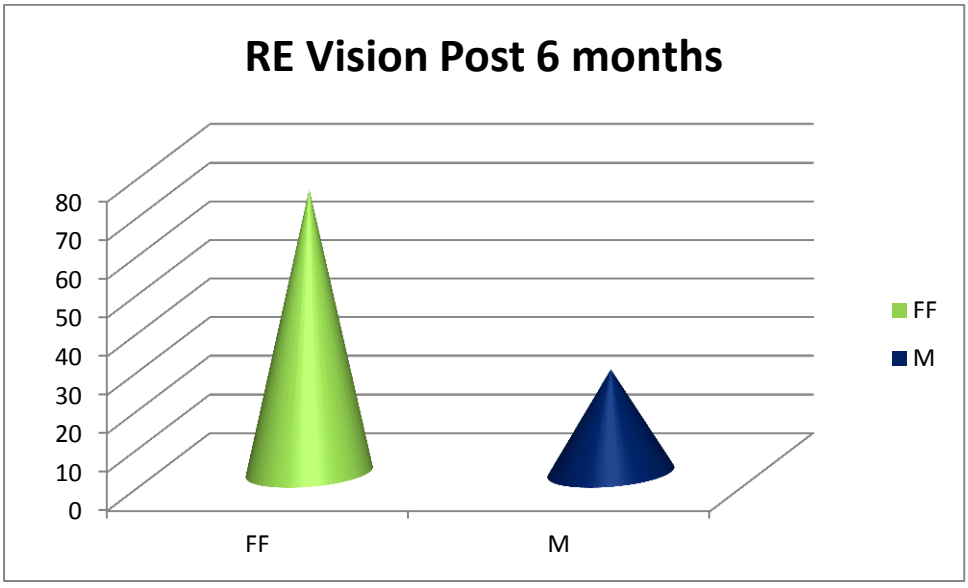


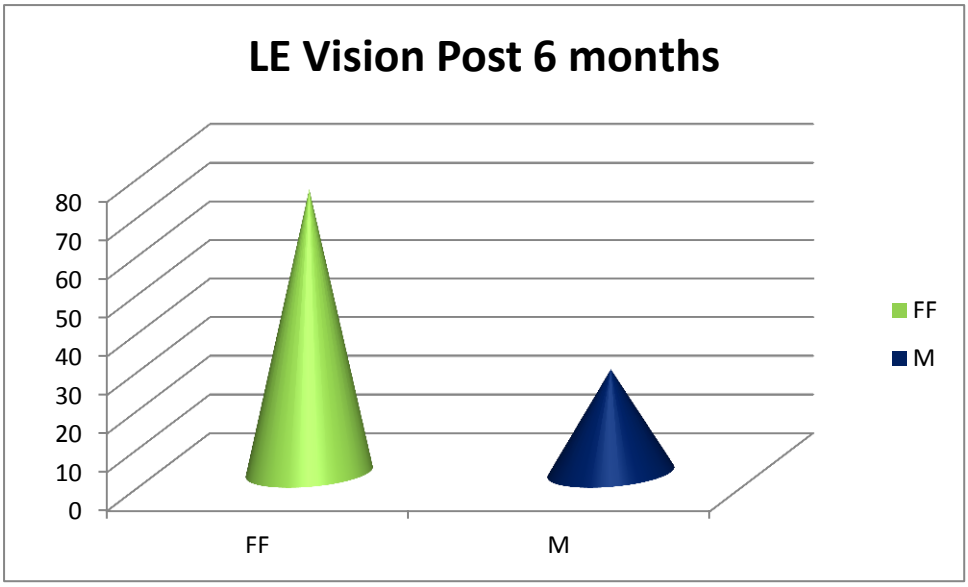
Table 15 : Vision at 6 months of Post Operative Period

LEFT EYE

LE VISION – MONTH 6 POST OP	FREQ.	PERCENT
FF	11	73.33
M	4	26.67
Total	15	100

Chart 15 : Vision at 6 months of Post Operative Period

LEFT EYE



In our study, a total of 22 eyes (73.33 %) showed same vision of Fixing and Following Light whereas a total of 8 eyes (26.67 %) showed refractive status of Myopia Post operatively.

12. CORNEA STATUS AT 6 MONTHS POST OPERATIVE

Table 16 : Status of Cornea at 6 months of Post Operative Period

RIGHT EYE

RE CORNEA STATUS – MONTH 6 POST OP	FREQ.	PERCENT
CLEAR	2	13.33
HHS	4	26.67
HS	1	6.67
MH	8	53.33
Total	15	100

Chart 16 : Status of Cornea at 6 months of Post Operative Period

RIGHT EYE

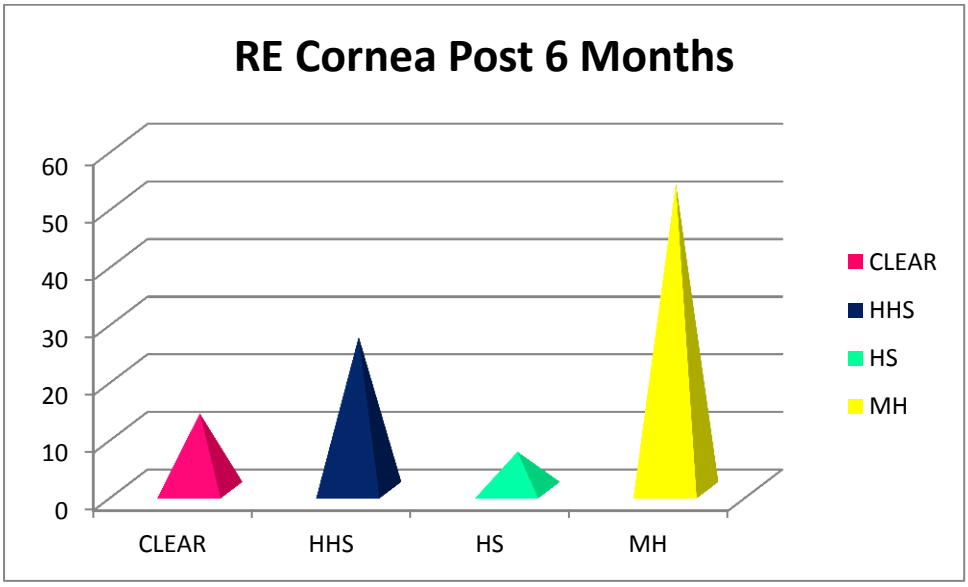


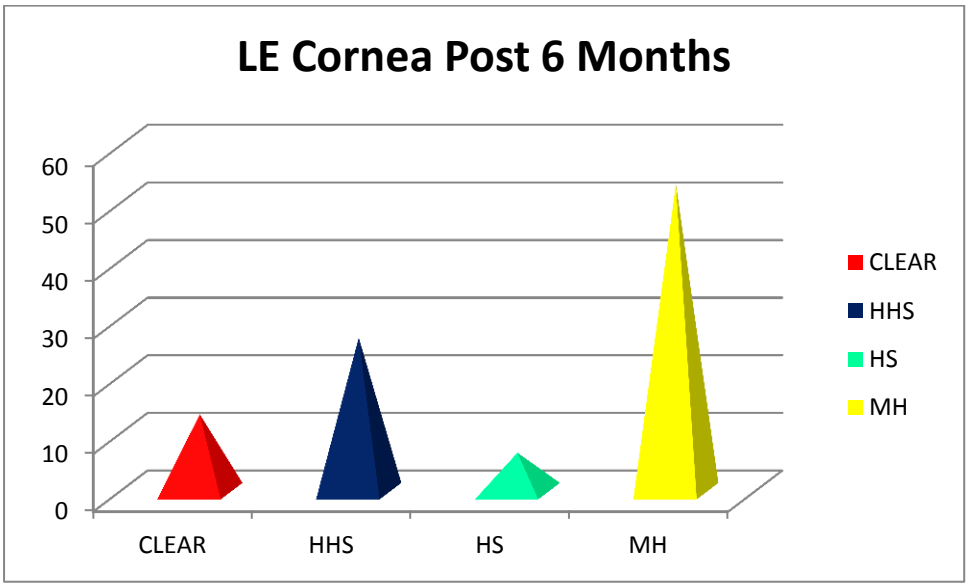
Table 17 : Status of Cornea at 6 months of Post Operative Period

LEFT EYE

RE CORNEA STATUS – MONTH 6 POST OP	FREQ.	PERCENT
CLEAR	2	13.33
HHS	4	26.67
HS	1	6.67
MH	8	53.33
Total	15	100

Chart 17 : Status of Cornea at 6 months of Post Operative Period

LEFT EYE



In our study, a total of 16 eyes bilaterally (53.33 %) showed only Mild Haze, Total of 8 eyes bilaterally (26.67 %) showed Healing of Haab's Striae, total of 4 eyes (13.33 %) had clear cornea and 2 eyes totally (6.67%) retained Haab's Striae.

13. POST OPERATIVE MEDICATIONS NEEDED :

Table 18 : NUMBER OF POST OPERATIVE MEDICATIONS NEEDED

RIGHT EYE

MEDICATIONS – RIGHT EYE	FREQ.	PERCENT
BTX (One medication)	7	46.67
NIL	8	53.34
Total	15	100

Chart 18 : NUMBER OF POST OPERATIVE MEDICATIONS NEEDED

RIGHT EYE

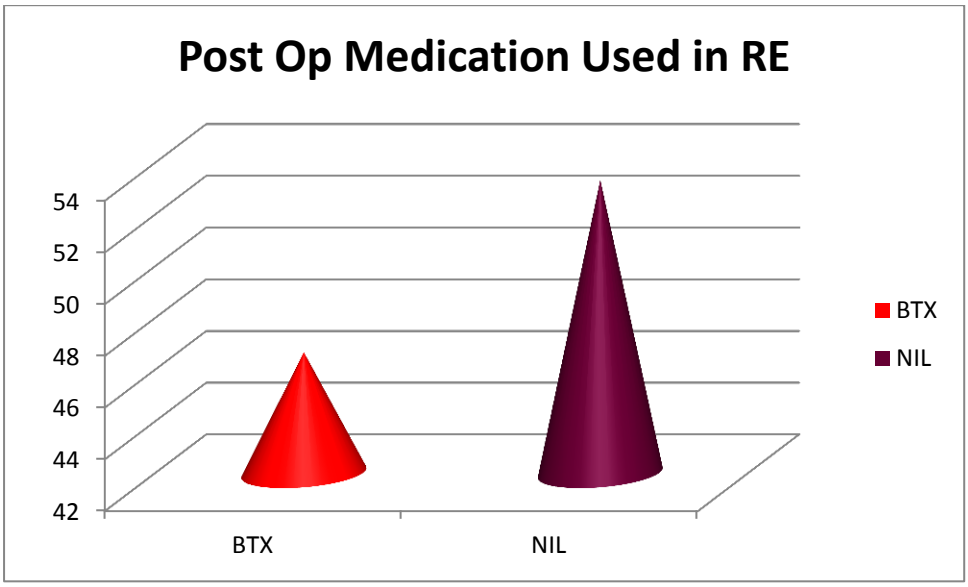


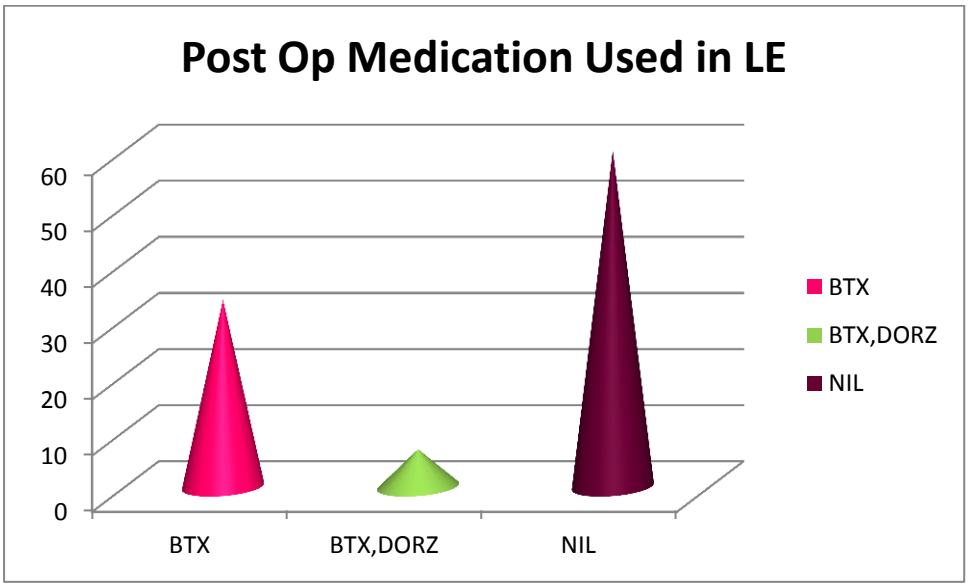
Table 19 : NUMBER OF POST OPERATIVE MEDICATIONS NEEDED

LEFT EYE

MEDICATIONS – LEFT EYE	FREQ.	PERCENT
BTX (One Medication)	5	33.33
BTX,DORZ (Two Medications)	1	6.67
NIL	9	60
Total	15	100

Chart 19 : NUMBER OF POST OPERATIVE MEDICATIONS NEEDED

LEFT EYE



In our study, majority 17 eyes needed no anti glaucoma medications post Operatively to control IOP, 12 eyes needed one medication and only one eye needed two medications post operatively to control IOP.

14. POST OPERATIVE IOP CONTROL

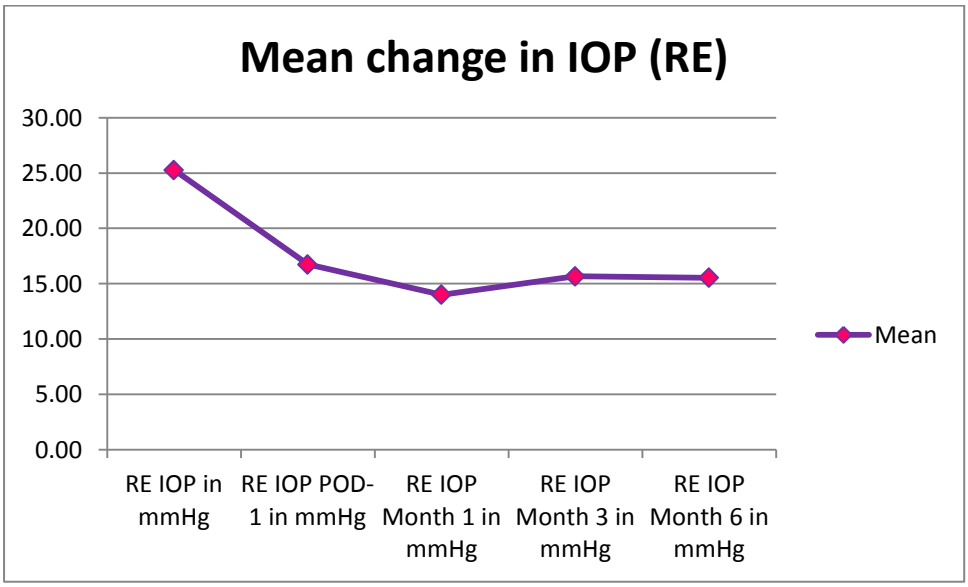
Table 20 : Comparison of IOP Control

RIGHT EYE

Variable	Obs	Mean	Std. Dev.
RE IOP Pre Op in mmHg	15	25.27	2.31
RE IOP POD 1 in mmHg	15	16.73	2.58
RE IOP Month 1 in mmHg	15	14.00	2.39
RE IOP Month 3 in mmHg	15	15.67	1.88
RE IOP Month 6 in mmHg	15	15.53	2.13

Chart 20 : Comparison of IOP Control

RIGHT EYE



Tables above describes a comparison between the mean pre- and post-operative IOP for the different follow-up periods in this study. It shows the steady reduction of mean IOP from the pre-operative period over the various follow-up visits.

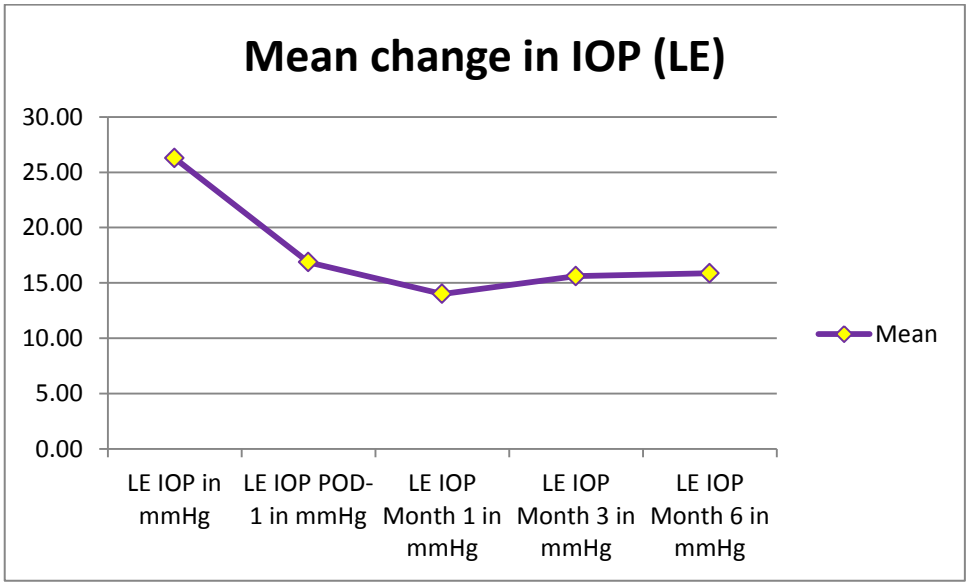
Mean Pre Operative IOP was 25.27mmHg which reduced to a Mean of 16.73 mmHg in POD 1, 14mmHg in Month 1, 15.67mmHg in Month 3, 15.53mmHg in Month 6 among the Right eyes which were operated first.

The peak reduction in mean IOP was seen on the First Month of post-operative period.

Table 21 : Comparison of IOP Control
LEFT EYE

Variable	Obs	Mean	Std. Dev.
LE IOP in mmHg	15	26.27	3.17
LE IOP POD 1 in mmHg	15	16.87	2.20
LE IOP Month 1 in mmHg	15	14.00	1.89
LE IOP Month 3 in mmHg	15	15.60	1.84
LE IOP Month 6 in mmHg	15	15.87	2.64

Chart 21 : Comparison of IOP Control
LEFT EYE



Tables above describes a comparison between the mean pre- and post-operative IOP for the different follow-up periods in this study. It shows the steady reduction of mean IOP from the pre-operative period over the various follow-up visits.

Mean Pre Operative IOP was 26.27mmHg which reduced to a Mean of 16.87 mmHg in POD 1, 14mmHg in Month 1, 15.60mmHg in Month 3, 15.87mmHg in Month 6 among the Left eyes.

The peak reduction in mean IOP was seen on the First Month of post-operative period.

Table 22 : Pre and Post Operative IOP difference on POD 1

Pre op Post op IOP Difference at the end of POD1	**Obs**	**Mean**	**Std. Dev.**	**P Value**
RE	15	8.53	2.39	<0.01
LE	15	9.4	2.17	<0.01

In our study, there was a Mean Difference in IOP in the range of 8.53mmHg – 9.4mmHg reduction in IOP in the POD 1 compared pre operatively which was statistically significant **p < 0.01**.

Table 23 : Pre and Post Operative IOP difference on PO Month 1

Pre op Post op IOP Difference at the end of 1 Month	Obs	Mean	Std. Dev.	P Value
RE	15	11.27	2.25	<0.01
LE	15	12.27	2.31	<0.01

In our study, there was a Mean Difference in IOP in the range of 11.27mmHg – 12.27mmHg reduction in IOP in the Post Operative Month 1 compared pre operatively which was statistically significant **p < 0.01**.

The peak reduction in mean IOP was seen on the First Month of post-operative period.

Table 24 : Pre and Post Operative IOP difference on PO Month 3

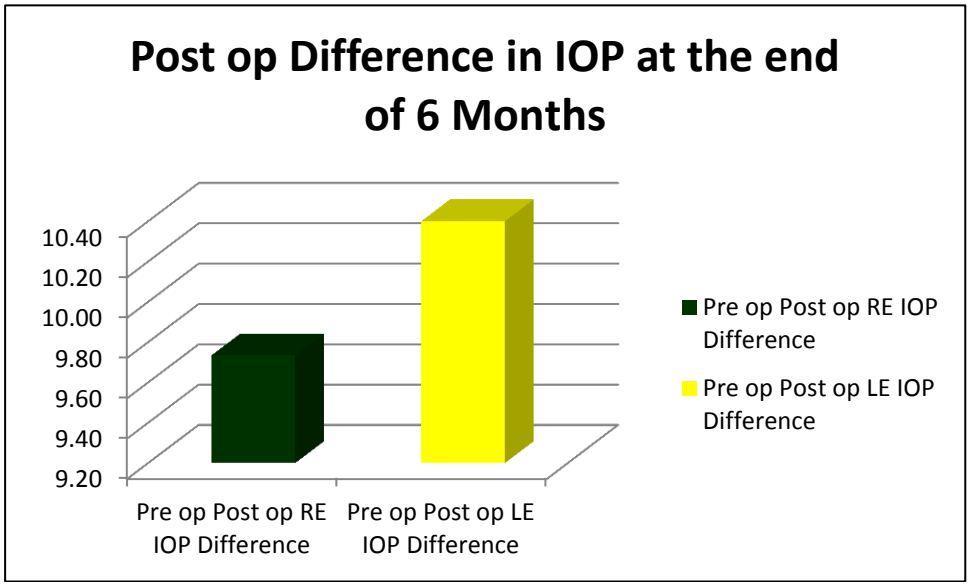
Pre op Post op IOP Difference at the end of 3 Month	Obs	Mean	Std. Dev.	P Value
RE	15	9.6	2.29	<0.01
LE	15	10.67	3.02	<0.01

In our study, there was a Mean Difference in IOP in the range of 9.6mmHg – 10.67mmHg reduction in IOP in the Post Operative Month 3 compared pre operatively which was statistically significant **p < 0.01**.

Table 25 : Pre and Post Operative IOP difference on PO Month 6

Pre op Post op IOP Difference at the end of 6 Months	Obs	Mean	Std. Dev.	P Value
RE	15	9.73	2.28	<0.01
LE	15	10.40	3.22	<0.01

Chart 22 : Pre and Post Operative IOP difference on PO Month 6



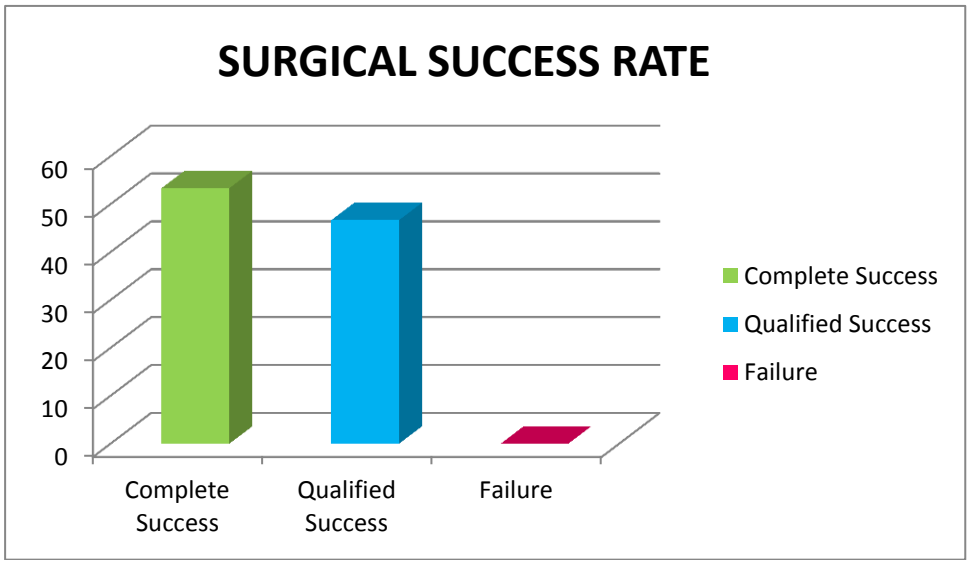
In our study, there was a Mean Difference in IOP in the range of 9.73mmHg – 10.40mmHg reduction in IOP in the Post Operative Month 6 compared pre operatively which was statistically significant **p < 0.01**.

There was a statistically significant reduction in the mean IOP for all follow-up periods.

Table 26 : Estimate of Surgical Success

SURGICAL SUCCESS	PERCENT
Complete Success	53.33
Qualified Success	46.67
Failure	0
Total	100

Chart 23 : Estimate of Surgical Success



Tables shows the percentage of eyes with surgical success/failure at the final follow-up visit.

Complete Success was seen in 53.33% of eyes.

Qualified success was seen in 46.67% of eyes at final follow-up visit.

DISCUSSION

1. **AGE :** Since our study included cases of Primary Congenital Glaucoma, all patients presented with symptoms since birth. All patients presented with age group between two months of age upto maximum of fourteen months of age. Previous studies also show comparable presentation since all cases of Primary Congenital Glaucoma present similarly from birth. Late presentation is more common in secondary glaucoma and phacomatoses.
2. **GENDER :** In our study, there was a male preponderance (86.67 %). Previous studies have shown no significant gender preponderance.
3. **EYE INVOLVED (LATERALITY) :**

   In our study, all patients had bilateral presentation. This was similar to previous studies with Primary Congenital Glaucoma, since all similar patients present since birth. Unilateral presentation is more common in secondary glaucoma and phacomatoses.

4. BIRTH HISTORY :

In our study, most patients 80 % were born of nonconsanguinous Marriage through an uncomplicated Normal Vaginal Delivery.

Also 93.33% were Full Term at birth. Previous studies also showed no statistically significant association between Consanguinity or Gestational Age with the incidence of Primary Congenital Glaucoma.

5. VISION :

In our study, most patients were able to just Fix and Follow light 91.67% due to severity of presentation and corneal haze. VA was not recorded for 3 eyes. This could be due to the young age of the majority of the patients and challenges in recording visual acuity in this age group in this setting. Also most of these eyes had clouded corneas and many had photophobia, which may have made it either difficult or impossible to measure VA.

6. CORNEAL STATUS :

In our study, 7 cases (46.67%) showed bilaterally severe Haze of cornea, 1 case showed bilaterally severe Haze with Haab's Striae whereas other eyes showed varying presentation of mild Haze with or without Haab's striae.

This was similar to previous studies as this was the common presentation in all cases of Primary Congenital Glaucoma.

7. CORNEAL DIAMETER :

Our study clearly demonstrates that all eyes had increased vertical and horizontal corneal diameter > 12mm indicating that Buphthalmos and Megalocornea are most common associations with Primary Congenital Glaucoma as seen in similar previous studies.

8. PRE OPERATIVE IOP :

In our study, All patients had elevated IOP >21mmHg to be diagnosed as Primary Congenital Glaucoma.

9. OTHER PRE OPERATIVE CHARACTERISTICS :

In our study, 7 cases (46.67%) showed bilaterally severe Haze of cornea, 1 case showed bilaterally severe Haze with Haab's Striae whereas other eyes showed varying presentation of mild Haze with or without Haab's striae.

In this study, the mean horizontal diameter was 12.40 mm and 12.57 mm respectively for right eye and left eye. Whereas the vertical diameter was 12.37 and 12.40 mm respectively.

This was comparable to many previous studies which concluded that Megalocornea and Buphthalmos with Haab's Striae was the most common

presentation of Primary Congenital Glaucoma. This was due to the fact that Raised IOP must have been present in the developing age group when scleral stretching was still possible for buphthalmos to develop.

For the same reason of pre operative presentation of severe Corneal Haze, the Fundus examination and assessment of Cup Disc ratio was difficult for all patients. Hence the main determining factor of the Optic Nerve Head status could not be reliably included in this study. This was a major limiting factor.

10. NUMBER OF MEDICATIONS NEEDED TO CONTROL IOP :

In our study, 18 eyes 60% of patients needed one medication of the Beta Blocker Group to control IOP whereas 12 eyes 40% of patients needed two medication – One Beta Blocker and one Carbonic Anhydrase Inhibitor additionally to control IOP.

Medical therapy is often ineffective and surgery is the ultimate management. However, medical therapy still has a role, usually to lower the IOP and clear the cornea enough to allow angle surgery. Drugs can also be used when surgery is inappropriate or high risk, for instance in life-threatening contraindications to anaesthesia. The usual agents, such as β-adrenergic antagonists or carbonic anhydrase inhibitors (CAI) have been employed as provisional therapy before surgery. However, these drugs have a limited long-term role in the management of PCG. Medical

therapy is relatively ineffective and also poorly tolerated long term in children due to serious potential side effects.

11. SURGERY DONE :

All patients after adequate IOP control with medical management and after Obtaining fitness for surgical procedure, Combined Trabeculotomy and Trabeculectomy in the same sitting was performed and followed up.

12. POST OPERATIVE IOP CONTROL AND SIGNIFICANCE :

It shows the steady reduction of mean IOP from the pre-operative period over the various follow-up visits.

Mean Pre Operative IOP was 25.27mmHg which reduced to a Mean of 16.73 mmHg in POD 1, 14mmHg in Month 1, 15.67mmHg in Month 3, 15.53mmHg in Month 6 among the Right eyes which were operated first.

The peak reduction in mean IOP was seen on the First Month of post-operative period.

Mean Pre Operative IOP was 26.27mmHg which reduced to a Mean of 16.87 mmHg in POD 1, 14mmHg in Month 1, 15.60mmHg in Month 3, 15.87mmHg in Month 6 among the Left eyes.

The peak reduction in mean IOP was seen on the First Month of post-operative period.

In our study, there was a Mean Difference in IOP in the range of 9.73mmHg – 10.40mmHg reduction in IOP in the Post Operative Month 6 compared pre operatively which was statistically significant **p < 0.01**.

There was a statistically significant reduction in the median IOP for all follow-up periods.

This was comparable to previous studies done by Elder MJ and Mullanay et al Which also showed significant reduction in Mean IOP following Combined Trabculotomy and Trabeculectomy [22][24].

13. POST OPERATIVE CHARACTERISTICS :

In our study, a total of 22 eyes (73.33 %) showed same vision of Fixing and Following Light whereas a total of 8 eyes (26.67 %) showed refractive status of Myopia Post operatively.

In our study, a total of 16 eyes bilaterally (53.33 %) showed only Mild Haze, Total of 8 eyes bilaterally (26.67 %) showed Healing of Haab's Striae, total of 4 eyes (13.33 %) had clear cornea and 2 eyes totally (6.67%) retained Haab's Striae.

This clearly showed that on attaining good IOP control post operatively, there was Definite improvement in the Corneal Haze and Healing of Haab's Striae. Thus there was improvement in the Refractive status in the follow up period. However Long Term Follow Up is needed to assess the complete Corneal Clearing, To assess the stability of corneal status and Reversal of Optic Disc cupping And to determine the exact Refraction of the patients. These were the Limitations of the study.

The difficulties in analyzing VA for PCG patients are well-recognized and are due to age of patients and corneal status. Essuman et al. reported that data on VA and refractive status of their patients was too inadequate for them to analyze statistically.[3] In this study, pre-operative refraction was only done in only 1 eye whilst post-operative refraction was done in 4 eyes. This may reflect the improvement in corneal status of eyes or older age of patients, which would make refraction more feasible.

Some eyes with good IOP control remained not clear due to corneal scarring. Essuman et al. similarly reported that although all eyes in their study had clouded corneas before surgery, majority achieved clear corneas at final follow-up visit[18]. Likewise, Bowman et al. reported an increase in the number of eyes with clear corneas from 8.5% pre-operatively to 78% at final follow-up visit[17].

15.POST OPERATIVE USE OF ANTI GLAUCOMA MEDICATIONS :

In our study, majority 17 eyes needed no anti glaucoma medications post Operatively to control IOP, 12 eyes needed one medication and only one eye needed two medications post operatively to control IOP. In our study, majority 17 eyes needed no anti glaucoma medications post Operatively to control IOP, 12 eyes needed one medication and only one eye needed two medications post operatively to control IOP.

Previous studies also comparably show the similar results following successful Combined Trabculotomy and Trabeculectomy where the number of medications needed were reduced.

14. SURGICAL SUCCESS / FAILURE :

Complete Success was seen in 53.33% of eyes.

Qualified success was seen in 46.67% of eyes at final follow-up visit.

Success of combined trabeculotomy and trabeculectomy defined as

- **Complete success :** IOP >5mmHg and <21mmHg without glaucoma medications or further glaucoma surgery.
- **Qualified success :** IOP >5mmHg and <21mmHg with glaucoma medications or further glaucoma surgery.

- **Failure :** includes
    - IOP ≤5mmHg or ≥21mmHg at the last visit
    - Need for additional glaucoma surgeries

This was comparable to Previous studies which showed Overall,

Qualified success was achieved in 73.3% of eyes in Indian scenario [16].

Zhang et al. assessed success of CTT in 81eyes of 48 patients and reported 1 year and 3 years success rates of 92.6% and 77.8% respectively[20] . All their patients at the time of diagnosis and presented with less advanced disease. This may explain their slightly higher surgical success rates.

When the Kaplan Meier curves were assessed, the cumulative probabilities of success were similar for CTT, remaining at approximately 80% at 2 years.

These findings correlate well with similar studies from literature. Autrata et al. looked at 83 eyes of 47 patients who underwent either CTT or primary trabeculotomy for PCG and reported 2-year success rates at 76% and 47% respectively.[21] In China, Zhang et al. similarly reported highest success rates for CTT compared to other procedures.[20]

This was also the case for Al Hazmi et al. in Saudi Arabia[23] . Of note is that for these 2 countries, patients also presented late with advanced disease, comparable to patients in our set-up.

CTT has been proposed to offer better success rates due to a dual outflow mechanism through Schlemm's canal (trabeculotomy) and the trabeculectomy fistula.

All these studies had Long follow up period of more than 1 year to assess the success rate[16] . But in our study we had only limited follow up period of 6 months, So the exact success rate and also the long term Failures could not be assessed.

The Failures and the need for repeat surgeries and poor visual outcome can only be determined after a longer follow up period.

SUMMARY

- Primary Congenital Glaucoma has presentation early since birth.
- No significant correlation with birth history like consanguinity or gestational age of patients.
- All patient's visual acquity testing revealed only Light fixation due to young age of patients and severe corneal haze at the time of presentation.
- All cases of Primary Congenital Glaucoma had Megalocornea and Buphthalmos with Haab's Striae at the presentation.
- The initial presenting IOP was high as for all cases of Primary Congenital Glaucoma which required initial Medical management to control IOP.
- Following Combined Trabeculotomy and Trabeculectomy, there was a statistically significant reduction in IOP in all the post operative visits when compared with Pre Operative IOP.
- The maximum reduction of Mean IOP was seen in the first month of post operative period.
- There was also an associated correlated reduction in the corneal haze and improvement in vision post operatively but still longer follow up periods are needed to assess the complete outcome.

- There was Complete Success in 53.33% of eyes and Qualified success in 46.67% of eyes at final follow-up visit with no Failures. This was because long term follow up is needed to determine and manage the failure rates and complications.

CONCLUSION

- Primary Congenital Glaucoma has an early age of presentation
- Medical therapy is often ineffective and surgery is the ultimate management. However, medical therapy still has a role, usually to lower the IOP and clear the cornea enough to allow angle surgery.
- Combined Trabeculotomy and Trabeculectomy is a safer and effective primary surgery for Primary Congenital Glaucoma with good success rate and better IOP control.
- IOP control following Combined Trabeculotomy and Trabeculectomy was statistically significant when compared with Pre Operative IOP.
- Longer follow up periods is needed for determining the stability and clearing of corneal status, reversibility of optic disc cupping, establishment of visual rehabilitation and assessment of failure rates and complications.

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PROFORMA FOR CONGENITAL GLAUCOMA

Name of the patient: IP No:
Age: Sex: Informant:
Place:

Complaints: Opacity in the black portion of the eye
Photophobia
Watering of eyes
Prominence of eyes

Antenatal history:

Consanguinity:

Birth history: FTND/ LSCS
Preterm
Birth asphyxia
Birth trauma
Congenital anomalies

Developmental history:

Siblings:

Family history:

Treatment History:

General Examination:
Congenital anomalies:
Facial asymmetry:

Systemic Examination:
Higher functions
CVS
RS
P/A

Ocular Examination: RE LE

- Blepharospasm
- Vision
- Lids
- EOM
- Conjunctiva
- Cornea
- Anterior chamber
- Iris
- Pupil
- Lens

Examination under general anaesthesia:

- Corneal diameter:
  - Horizontal
  - Vertical
- Axial Length
- Intra Ocular Pressure :
- Fundus :
  - RE
  - LE

Diagnosis:

Treatment:

- Medical:
- Surgical:

INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI 600 003

EC Reg.No.ECR/270/Inst./TN/2013
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CERTIFICATE OF APPROVAL

To
Dr.R.Anandhi
I Year Post Graduate in MS Ophthalmology
Regional Institute of Ophthalmology & GOH/
Madras Medical College
Chennai

Dear Dr.R.Anandhi,

The Institutional Ethics Committee has considered your request and approved your study titled **"ANALYSIS OF THE SURGICAL OUTCOMES IN CONGENITAL GLAUCOMA FOLLOWING COMBINED TRABECULOTOMY AND TRABECULECTOMY " - NO.08012018**

The following members of Ethics Committee were present in the meeting hold on **09.01.2018** conducted at Madras Medical College, Chennai 3

1. Prof.P.V.Jayashankar	:Chairperson
2. Prof.R.Narayana Babu,MD.,DCH., Dean,MMC,Ch-3	: Deputy Chairperson
3. Prof.Sudha Seshayyan,MD., Vice Principal,MMC,Ch-3	: Member Secretary
4. Prof.N.Gopalakrishnan,MD,Director,Inst.of Nephrology,MMC,Ch	: Member
5. Prof.S.Mayilvahanan,MD,Director,Inst. of Int.Med,MMC, Ch-3	: Member
6. Prof.A.Pandiya Raj,Director, Inst. of Gen.Surgery,MMC	: Member
7. Prof.Shanthy Gunasingh, Director, Inst.of Social Obstetrics,KGH	: Member
8. Prof.Rema Chandramohan,Prof.of Paediatrics,ICH,Chennai	: Member
9. Prof. Susila, Director, Inst. of Pharmacology,MMC,Ch-3	: Member
10.Prof.K.Ramadevi,MD., Director, Inst. of Bio-Chemistry,MMC,Ch-3	: Member
11.Prof.Bharathi Vidya Jayanthi,Director, Inst. of Pathology,MMC,Ch-3	: Member
12.Thiru S.Govindasamy, BA.,BL,High Court,Chennai	: Lawyer
13.Tmt.Arnold Saulina, MA.,MSW.,	:Social Scientist
14.Thiru K.Ranjith, Ch- 91	: Lay Person

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

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

Member Secretary – Ethics Committee

MEMBER SECRETARY
INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE
CHENNAI-600 003

URKUND

Urkund Analysis Result

Analysed Document:	A STUDY ON ANALYSIS OF SURGICAL OUTCOMES IN CONGENITAL GLAUCOMA FOLLOWING COMBINED TRABECULOTOMY AND TRABECULECTOMY.docx (D57517368)
Submitted:	10/23/2019 1:35:00 PM
Submitted By:	anandhi.mbbs4@gmail.com
Significance:	3 %

Sources included in the report:

https://www.ncbi.nlm.nih.gov/pubmed/9627644

Instances where selected sources appear:

2

KEY TO MASTERCHART

REG.NO	-	REGISTRATION NUMBER
S.NO	-	SERIAL NUMBER
RE	-	RIGHT EYE
LE	-	LEFT EYE
BE	-	BOTH EYES
M	-	MALE
F	-	FEMALE
CSG	-	CONSANGUINITY
GA	-	GESTATIONAL AGE
2 DEG	-	SECOND DEGREE
FT	-	FULL TERM
PT	-	PRE TERM
NVD	-	NORMAL VAGINAL DELIVERY
LSCS	-	LOWER SEGMENT CESAEREAN SECTION
FF	-	FIXES AND FOLLOWS LIGHT
M	-	MYOPIA
MH	-	MILD HAZE
SH	-	SEVERE HAZE
HS	-	HAAB'S STRIAE
HHS	-	HEALING HAAB'S STRIAE
H	-	HORIZONTAL
V	-	VERTICAL
IOP	-	INTRA OCULAR PRESSURE
NV	-	NO VIEW
VH	-	VIEW HAZY
BTX	-	BETOXALOL
DORZ	-	DORZOLAMIDE

S. NO.	NAME	AGE (months)	SEX	REG.NO	BIRTH HISTORY			PRE OPERATIVE EXAMINATION													POST OPERATIVE FOLLOW UP															
					CSG	GA	MODE	VISION		CORNEA		CORNEA DIAMETER				IOP		CUP DISC RATIO		MEDICATIONS NEEDED	POD 1		1ONTH		1ONTH		MONTH 6									
																					IOP		IOP		IOP		VISION		IOP		CORNEA		CUP DISC RATIO		MEDICATIONS NEEDED	
								RE	LE	RE	LE	RE		LE		RE	LE				RE	LE	RE	LE	RE	LE	RE	LE	RE	LE						
												H	V	H	V																					
1	JACINTHA	4	F	10627	NIL	FT	NVD	FF	FF	SH	SH	11	11	12	11	22	27	NV	NV	BE BTX	14	16	10	12	14	14	FF	FF	16	14	MH	MH	NV	VH 0.6	NIL	NIL
2	DHANUSH	3	M	10698	2 DEG	FT	NVD			SH	SH	13	12	14	13	23	26	NV	NV	BE BTX	19	17	14	14	15	17	FF	FF	14	17	MH	MH	NV	NV	NIL	NIL
3	AKSHAYA	6	F	11263	NIL	FT	NVD	FF	FF	SH,HS	SH,HS	13	13	13	13	27	30	NV	NV	BE BTX, DORZ	17	18	15	15	17	16	FF	FF	17	19	MH	MH	NV	NV	BTX	BTX
4	KUSHAL	4	M	11312	NIL	FT	NVD	FF	FF	MH	MH	13	12	11	10	22	24	NV	NV	BE BTX	15	17	15	14	16	14	FF	FF	13	14	CLEAR	CLEAR	0.5	0.6	NIL	NIL
5	KIRAN	4	M	11397	NIL	PT	LSCS	FF	FF	HS	HS	12	13	12.5	13	28	28	NV	NV	BE BTX, DORZ	16	17	12	14	13	16	FF	FF	13	15	HS	HS	0.6	0.6	BTX	BTX
6	DILIPAN	8	M	12113	2 DEG	FT	NVD	FF	FF	HS	HS	11	12	12	12	23	25	NV	NV	BE BTX	10	12	8	10	12	11	M	M	12	14	HHS	HHS	0.6	0.6	NIL	NIL
7	DINESH	12	M	12258	NIL	FT	NVD	FF	FF	HS	HS	14	13	13	13	26	30	NV	NV	BE BTX, DORZ	16	20	14	16	14	15	M	M	13	12	HHS	HHS	0.6	0.8	NIL	NIL
8	SANJAY	6	M	12643	NIL	FT	NVD	FF	FF	SH	SH	13	14	12	13	30	32	NV	NV	BE BTX, DORZ	19	20	17	17	17	18	FF	FF	19	21	MH	MH	NV	NV	BTX	BTX,DORZ
9	GOUTHAM	5	M	13176	NIL	FT	NVD	FF	FF	MH	MH,HS	12	11	12	12	24	22	NV	NV	BE BTX	17	15	14	12	15	15	FF	FF	16	14	HHS	HHS	VH 0.7	VH 0.7	NIL	NIL
10	UDAY	6	M	13351	NIL	FT	NVD	FF	FF	SH	SH	14	13.5	14	14	27	25	NV	NV	BE BTX	18	18	16	14	18	16	FF	FF	18	19	MH	MH	NV	NV	BTX	BTX
11	SURYA	6	M	13690	NIL	FT	LSCS	FF	FF	SH	SH	13	13	13	13	25	23	NV	NV	BE BTX	17	17	14	13	16	14	FF	FF	18	13	MH	MH	NV	VH 0.8	BTX	NIL
12	MANOJ	14	M	13832	NIL	FT	NVD	M	M	HS	MH,HS	12	12	12	12	26	23	0.6	VH 0.7	BE BTX	19	15	16	14	18	16	M	M	16	17	CLEAR	CLEAR	O.6	0.7	NIL	NIL
13	ROSHAN	3	M	14582	NIL	FT	LSCS			SH	SH	12	13	13	13	27	29	NV	NV	BE BTX, DORZ	21	19	16	17	18	18	FF	FF	16	15	MH	MH	NV	NV	BTX	BTX
14	LATHISH	2	M	15367	2 DEG	FT	NVD			SH	SH	12	11	12.5	13	25	28	NV	NV	BE BTX, DORZ	16	18	15	15	17	17	FF	FF	17	19	MH	MH	NV	NV	BTX	BTX
15	KUMAR	8	M	15430	NIL	FT	NVD	FF	FF	MH,HS	MH,HS	11	12	12.5	11	24	22	VH 0.8	VH 0.8	BE BTX	17	14	14	13	15	17	M	M	15	15	HHS	HHS	0.8	0.8	NIL	NIL