A Dissertation on

PERIOPERATIVE COMPLICATIONS IN PATIENTS WITH PSEUDOEXFOLIATION UNDERGOING SMALL INCISION CATARACT SURGERY

Dissertation submitted in partial fulfillment of the regulations for the award of

M.S. DEGREE

IN

OPHTHALMOLOGY

TAMIL NADU

DR. M.G.R. MEDICAL UNIVERSITY

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APRIL – 2015

DECLARATION

I hereby declare that this dissertation entitiled **PERIOPERATIVE COMPLICATIONS IN PATIENTS WITH PSEUDOEXFOLIATION UNDERGOING SMALL INCISION CATARACT SURGERY** is a bonafide and genuine research work Carried out by me under the guidance of Dr. M.Hemanandini. M.S.,(ophthal),D.O, Head of the Department, Department of Ophthalmology, Coimbatore Medical College & Hospital, Coimbatore.

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CERTIFICATE

This is to certify that the dissertation entitled "**PERIOPERATIVE COMPLICATIONS IN PATIENTS WITH PSEUDOEXFOLIATION UNDERGOING SMALL INCISION CATARACT SURGERY**is a bonafide and genuine research work Carried out by Dr.R.Jayanthi in partial fulfilment of the requirement for the degree of Master of Surgery in Ophthalmology.

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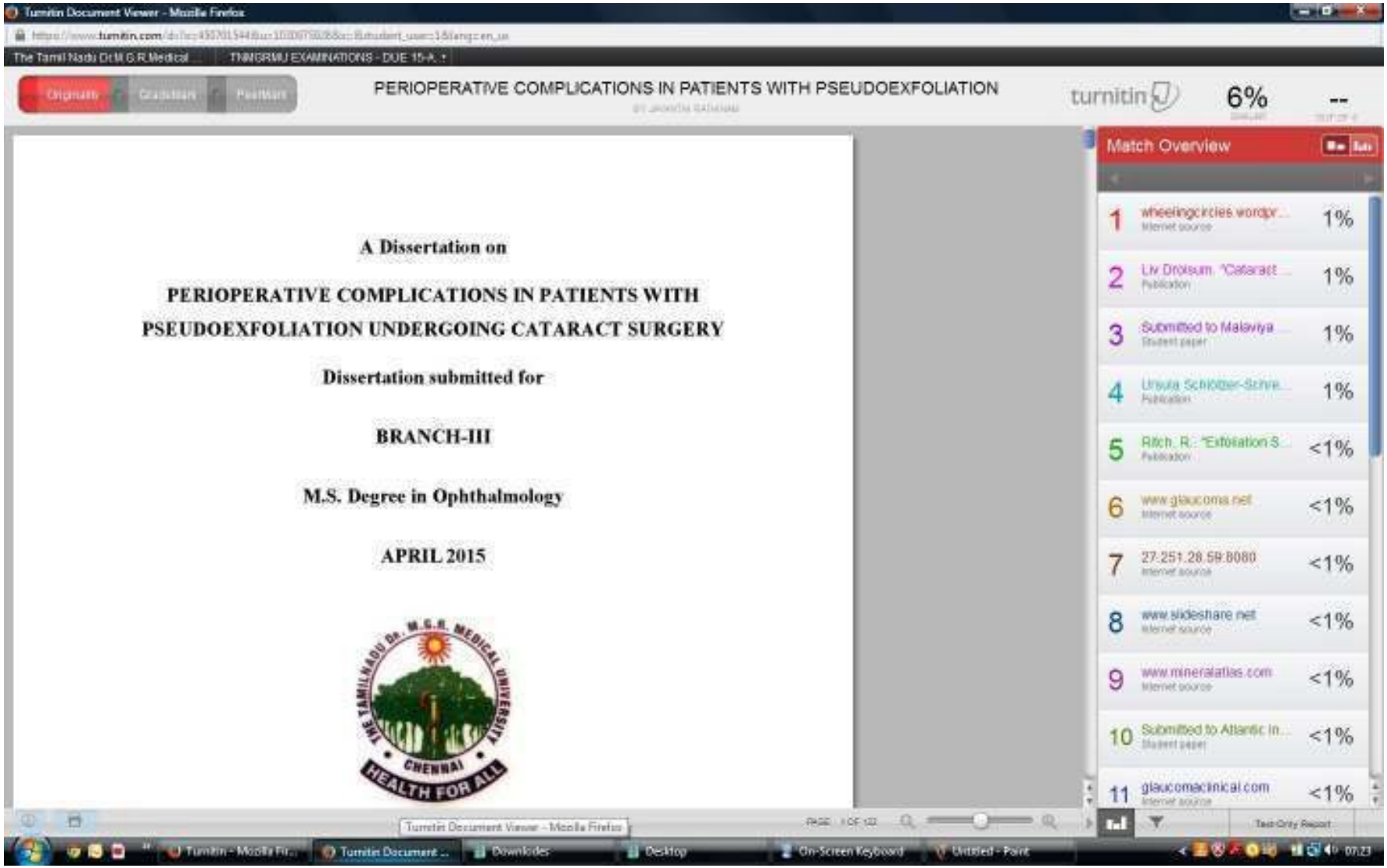
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ABBREVIATIONS

PEX/PXF	-	Pseudoexfoliation
XFS	-	Pseudoexfoliation syndrome
XFG/PEXG	-	Pseudoexfoliation glaucoma
LOXL	-	Lysyl oxidase like gene
IOP	-	Intraocular pressure
IOL	-	Intraocular Lens
CTR	-	Capsular Tension Ring
CTS	-	Capsular Tension Segment
OVD	-	Ophthalmic Viscosurgical Devices
CCC	-	Continuous Curvilinear Capsulorhexsis
PCR	-	Posterior Capsular Rent
TGF	-	Transforming Growth Factor
PMMA	-	Polymethylene metha acrylate
Nd YAG	-	Neodymium doped Yttrium Aluminium Garnett
ECCE	-	Extracapsular Cataract Surgery
AC	-	Anterior Chamber
VL	-	Vitreous loss
ID	-	Iridodonesis
ZD	-	Zonular dialysis
DC	-	Difficulty in Capsulotomy
TM	-	Trabecular meshwork

INTRODUCTION

Pseudoexfoliation syndrome is an age related generalized disorder involving the eyes, particularly[1]. It forms the most common cause of open angle glaucoma[2].

Apart from open and closed angle glaucoma, it also has intra-operative and post-operative risks in the patients undergoing cataract surgery[1].

Pseudoexfoliation syndrome is associated with systemic disorders such as Hypertension, angina, coronary artery disease, retinal vascular disease, peripheral vascular disease[3]. Additonally, PEX is associated with sensorineural hearing loss[3].

Pseudoexfoliation is most commonly seen in old people, in their late 60s and early 70s. It may be unilateral or bilateral and 50% of them become bilateral over a period of 20 years[4]. In the eye, pseudoexfoliation is characterized clinically by progressive production and accumulation of small fibrillar extracellular material. Most commonly these dandruff like deposits are seen over the pupillary margin and the anterior lens capsule[3,5].

The most consistent diagnostic feature is the targetlike pattern on the anterior capsule of the lens and they are best seen after pupillary dilation[3,5,6].

1. A central disc translucent in nature with occasional curled edges.
2. Intermediate clear zone probably due to the movement of iris that rubs the material off.
3. Peripheral granular zone with scalloped margins.

Central zone is absent in 20% or more cases, but the peripheral zone is a more consistent finding. Hence it warrants dilation of the pupil for the examination to be complete[5].

Pseudoexfoliation material is also seen over the corneal endothelium, ciliarybody, zonules, anterior vitreous face and angle structures. The associated features of pseudoexfoliation includes iris transillumination defect in the pupillary margin, poor pupillary dilatation, heterochromia iris.

More over the involved eye is miotic. Weak zonules with lens instability results in subluxation or dislocation and variable chamber depth[3,5,6,7].

Patients with pseudoexfoliation syndrome are notorious for development of pseudo exfoliation glaucoma hence these patients should be viewed as glaucoma suspects[8]. A complete ophthalmic examination including a slit lamp examination, Intra ocular pressure measurements, gonioscopy, visual field testing, optic nerve head examination with nerve fibre quantification is a must.

Presence of secondary open-angle glaucoma is known as glaucoma capsulare[5]. PEX glaucoma has more serious and worse clinical prognosis than primary open-angle glaucoma, often not responding to medical management and requiring early surgical intervention [3,5,6,7]. Angle closure glaucoma is also seen due to pupillary block by forward movement of lens[5]. Corneal endothelium shows decreased cell count and pleomorphism leading to early corneal decompensation at moderate rise in intraocular pressure after cataract surgery[9]. An increased incidence of nuclear cataract was also seen in the eye with pseudoexfoliation[10].

Making the diagnosis of pseudoexfoliation is very important and requires a careful examination under slitlamp after pupillary dilation or otherwise it may go unnoticed and results in unexpected complications.

REVIEW OF LITERATURE

History:

The history of pseudoexfoliation syndrome dates back to 1917 when it was first described by Finnish ophthalmologist John G.Lindberg[11]. Inspired by his senior colleague Axenfeld, a german ophthalmologist he observed and described the grayish white flakes in the pupillary margin and over the surface of the anterior lens capsule in older patients. He thought it could be due to prior inflammation[11].

Alfred vogt, a swiss ophthalmologist made the full description of pseudo exfoliation[12]. Formerly, in 1918 he described it as remnants of pupillary membrane present over the surface of anterior lens capsule. Later in 1925, he described it as exfoliation of the lens capsule. He also mentioned the presence of deposits over iris, back of cornea and made an association with glaucoma[13].

In 1928, Busacca studied the pseudo exfoliation material histologically after staining with haemotoxylin and eosin. He described it as discrete pinkish mass, either sessile or pedunculated over the anterior lens surface without any capsular dehiscence[14, 16].

In 1954, Georgiana Dvorak – Theobald coined the term "pseudo exfoliation"[15]. He differentiated it from true exfoliation of the lens capsule caused by infrared rays in glass blowers[15].

In 1964, Bertelsen, Drablos and Flood recommended the term fibrillopathia epithelio capsularis. He suggested pre equatorial lens epithelial cells produced the abnormal fibrillar substance[15].

In 1969, Vannas thought that the pseudo exfoliation material was blood borne since he observed abnormal leakage of fluorescein while doing iris fluorescence angiography[16].

In 1973 Ghosh and Speakman studied same peculiar changes in iris and ciliary body epithelium. This made them to propose that they are additional primary sites of pseudo exfoliation fibril[16].

Also in 1973 Ringvold observed deposition of pseudo exfoliation along the walls of conjunctival capillaries. The same findings were confirmed by Ghosh and Speakman in 1976[16].

In 1975 Pederson and Davanger studied under transmission electron microscopy and scanning electron microscopy. They commented "Pseudo exfoliation excrescences rest on a basal lamina" [16].

Eagle and colleagues believed that the material represented abnormal basement membrane secretions and hence they named it as basement membrane exfoliation syndrome.[17]

Recent ultra structural studies indicate the material is derived from lens capsule and hence can be called as exfoliation syndrome. The term pseudo exfoliation and exfoliation syndrome are used interchangeably in current literature[5].

Renewed interest in studying the pseudoexfoliation syndrome in the late 80's and 90's lead to the establishment of International Association for the study of pseudoexfoliation syndrome named after Lindberg – The Lindberg's Society[15].

Epidemiology:

The occurrence of Pseudo exfoliation syndrome is worldwide. But the rate of prevalence varies widely according to the geographical locations. This reflects a combination of true difference due to nutrition, climate, radiation, racial, ethnic or as yet unknown factors[18]. Also the clinical criteria used to identify the presence at the early stage of pseudo exfoliation, the method and thoroughness among the examiners should be improved.

Various studies conducted across the globe shows the prevalence of pseudo exfoliation increases with age. Mean age of presentation is between 60-70 years[19]. But some studies show the presentation of this condition in mid-adulthood too. Sex ratio reports are varying.

Prevalence studies of pseudo exfoliation shows 3.8% in South India[20], 6.45% in Pakistan[21], 39% in Egypt , 26% in Scandinavian countries[22], 5.5% in France, 20.6% in Brest[22] and 0.4% in Chinese population[23], 0% in Greenland Inuit. Also there is a greater variation in Spain with 0.5% in Madrid and 20% in Galicia[24].

Overall, it has a high prevalence among the Scandinavian countries and Arabian countries whereas rare among African Americans, Eskimos and Canadian Arctic populations[25].

In Iceland, study conducted by Jonasson et al reports 10% annual rise of pseudo exfoliation in people aged from 50 and above[26].

In US, Framingham Eye study revealed a rising prevalence of 0.5% in 52-64 yrs to 5% in 75-85 yrs[27].

In India Sood [28]N.N. (1965) reported the prevalence to be 1.88%. Lamba and Giridhar (1984) reported as 7.4%[29].

In South India Krishnadas et al (2003) reported the prevalence as 6%[30].

(AHEPS) Andhra pradesh eye disease study reported prevalence of 0.69% which increased to 3.01% in above 40 yrs and 6.28% in above 60 yrs old[31].

Genetic Association:

Pseudo exfoliation and pseudo exfoliation glaucoma demonstrates a strong familial aggregation, since it has got an increased relative risk on first degree relatives, twins, loss of heterozygosity. Also it has got a documented transmission through two generation pedigrees[32].

Tarkkanen A. (1962) suggested the possibility of a gene with three functions involving abnormality in aqueous drainage, pseudo exfoliation and degeneration of the iris pigment epithelium[33].

Kelvin Y.C. Lee et al studied about XFS/XFG association with polymorphism with R141L, G153D and intron located in the lysyloxidase like gene (LOXL) on chromosome 15q21[34].

R.R. Allinghan et al (2001) studied 6 icelandic families out of which atleast one affected by pseudo exfoliation syndrome and thought that it could be an inherited condition[35].

Thorleifsson et al showed a strong association between pseudo exfoliation syndrome and pseudo exfoliation glaucoma with three single nucleotide polymorphism of LOXLI gene. (rs1048661, rs3825942)[36].

Multiple inheritance patterns are suggested and it includes autosomal dominant, autosomal recessive, X linked recessive and mitochondrial inheritance[32].

LOXLI gene located at chromosome 15q24.1 is a member of lysyl oxidase gene family[37]. The gene is important for the biogenesis of connective tissue and especially in collagen cross linking. It is found in cornea, iris, ciliary body, lens capsule, optic nerve, trabecular meshwork and zonular fibers.

Moreover the exact mechanism which causes XFS/XFG has not been identified yet. Other genes associated with XFS/XFG are under study[37].

Hyperhomocysteinemia is found in PEX syndrome & PEX glaucoma[38].

STRUCTURE OF PSEUDO EXFOLIATION MATERIAL:

The structure of pseudo exfoliation material is a glycoprotein or proteoglycan. It includes a central protein core surrounded peripherally by complex sugars that are conjugated[39].

The main constituents are glycosaminoglycans and it includes heparin sulfate, chondroitin sulfate, dermatan sulfate and hyaluronic acid. The non collagenous portion includes basement membrane and elastic microfibril (Elastin, Vitronectin, amyloid P, laminin, nidogen, fibrillin 1, TGF binding protein 1 & 2, microfibril associated glycoprotein)[39].

In 1973, Ringvold anlaysed the amino acid profile of pseudo exfoliation material[40].

Davanger (1978) studied the individual pseudo exfoliation material and its thickness. It varies according to its site. Central zone has fibrils of 40- 60 nm in diameter. At pre-equatorial zones it is 10-40nm[41].

The adhesive nature of pseudo exfoliation material is due to a carbohydrate component Human natural Killer I[15].

Theories on origin of pseudo exfoliation material:

1. Basement Membrane theory:

According to the basement membrane theory, the pseudo exfoliation is due to a disorder of extra cellular matrix. It is characterized by overproduction or abnormal breakdown of cell surface associated material but the biochemical nature is not fully understood. The advent of electron microscope helped us to study the pseudo exfoliation material in detail. The pseudo exfoliation material is produced by the anterior lens epithelial cells present in the pre-equatorial zone, and also by the basement membrane of Iris, Ciliary body and Conjunctiva. With the help of transmission electron microscopy Schlotze-Schrehardt et al[42] in 1992 confirmed the existence of the pseudo exfoliation material in the extra ocular tissues. Typical pseudo exfoliation fibers were identified in lung, skin, kidney, liver, heart, gall bladder, blood vessels, extraocular muscle, connective tissue in orbit and in meninges in addition to the typical intraocular location.

Harnish et al in 1981 observed that the fibrils contained a basement membrane proteoglycan. He made the observation based on indirect immunoperoxidase method[43].

2. Elastic micro-fibril theory:

Immunologically exfoliation material is related to elastic tissue. This observation is based on the study made by Li et al in 1989. He proposed that exfoliation fibers have a peripheral binding site for the attachment of Amyloid P which is similar to those present on normal elastic fibers. Also there are similarities between exfoliation material and the zonular micro-fibrils histochemically and antigenically.

In 1984 Garner and Alexander proposed that oxytalan, is a constituent of the exfoliation fibrils. Usually oxytalan forms a micro fibrillar component of elastic tissue that is present in the body in areas of mechanical stress[44].

In 1987 Roh et al found mature and intermediate micro fibrils nearer to fibroblasts in close proximity to elastic tissue in the conjunctiva.

In 1987 Streeten et al found histochemical similarities between Zonular elastic micro-fibrils and pseudo exfoliation material and a resemblance of the larger micro-fibrils of a ground substance to Zonular and other oxytalan micro-fibrils. The strong anatomic association between pseudo exfoliation fibres with elastosis in conjunctival specimens led the authors to suggest that pseudo exfoliation fibers themselves might be a form of elastosis, possibly resulting from abnormal

aggregation of components related to elastic micro-fibrils. Pseudo exfoliation material demonstrated elastin and elastic micro-fibril protein. Hence their production might reflect an abnormal stimulus or defective regulation of matrix synthesis[45].

Schlolzer – Schrehardt et al in 1998, by analyzing the pseudo exfoliation material under electron microscopy demonstrated it to be fibrillin positive fibers[46].

Now the widely accepted concept suggests pseudo exfoliation syndrome is due to pathology in the extracellular matrix and it leads to the production of abnormal extracellular material aggregation and accumulation of it. But it never decomposes. Hence pseudo exfoliation is considered to be systemic elastosis affecting elastic micro fibrils primarily[38].

3. Amyloid theory:

In 1996, by examining with light and electron microscopy Repo L.P. Naucharinen et al made the study that the pseudo exfoliation material is associated with amyloid[47]. Also, miosis is associated with degenerative changes both in the muscular layer of iris and in stromal tissue.

Tsukahara and Matsuo observed patients with both primary familiar amyloidosis and exfoliation[48].

4. Lysozomal theory:

In 1980 Mizuno et al found histochemical evidence of high acid phosphatase activity, suggesting that lysozymes are involved in the production of exfoliation material. Possible rupture of pigment epithelial cells may account for lyzosomal involvement. Proteolytic enzymes present in lyzosomes may facilitate granular disintegration[49].

In 1982 Baba studied a lipoprotein in exfoliation material and felt that high permeability of vessels in the anterior segment is possibly a result of it[50].

He also found the material is a sulphated glycosaminoglycan and suggested that abnormal glycosaminoglycan metabolism precedes the formation of the material. Immunohistochemical studies suggest the pseudo exfoliative material is made of heparin sulfate, chondroitin sulfate, dermatan sulfate and hyaluoronic acid. The noncollagen part basement membrane and elastic microfibrills includes elastin, nidogen, fibronectin, amyloid P, laminin, fibrillin, latent TGF bining protein 1 and 2 and microfibrill associated glycoprotein. However the integral parts of molecules that are adhered to one another are still unknown.

Type IV collagen is restricted to a micro-fibrillar layer interposed between the capsular surface and typical exfoliative material. Type IV collagen mediates cells attachment and might be an instrumental adherence of exfoliation material to anterior lens capsule. Additional presence of elastin epitopes indicates that exfoliation material is a multi-component, expressed in a disordered extra-celluar matrix synthesis, including the incorporation of the non-collagenous basement membrane components. Extensive labeling of exfoliation material for chondroitin sulphate suggestes that an over-production and abnormal production of glycoasaminoglycans to be one of the key changes in this disorder. Exfoliation material contains but does not represent true basement membrane material because of absence of Type IV collagen and the additional presence of elastin epitopes.

5. Protein Sink Model:

In 2008, Lee RK proposed protein sink model. According to him, pseudo exfoliation material is formed as a result of aberrant nucleation protein or due to the complex binding of protein to others and forming a more complex unstable protein matrix. Ultimately the formed pseudo exfoliation material deposits upon some intraocular structures[51].

CLINICAL FEATURES:

1. Conjunctival changes:

In 1976, John S. Speakman reported conjunctival pseudo exfoliation material is an independent source which often occurs before the appearance of PEX in the anterior capsular surface of the lens[52].

In 1987, Andrew M. Prince et al grouped the patients as “pseudo exfoliation suspects”. These patients are negative for pseudo exfoliation material on the lens but their conjunctiva showed pseudo exfoliation material[53].

By studying the inferior bulbar conjunctival biopsies under transmission electron microscopy, he suggested that the presence of pseudo exfoliation material in conjunctiva is more prevalent and there may be a possibility of association glaucoma in a greater proportion.

In 2006 Haydar Erdogan et al studied the conjunctival impression cytology of pseudo exfoliation patients and observed the presence of tear film abnormalities. He suggested that the pseudo exfoliation glaucoma and pseudo exfoliation syndrome can cause surface changes in conjunctiva and thereby reduction in tear film functions.

Pseudo exfoliation material is also positive over conjunctival vessels[40]. Fluroescein angiography reveals loss of regular limbal vascular pattern and areas of neovascularisation and congestion of anterior ciliary vessels.

2. **Corneal Changes**:

Flakes of pseudo exfoliation material and pigment accumulation may be found diffusely scattered over the back of cornea in the form of vertical spindles similar to krukenberg spindle[7].

In 1989 Miyanke et al studied the cornea under specular and electron microscopy and he postulated that the corneal endothelium is affected both qualitatively and quantitatively by the presence of pseudo exfoliation material. The corneal endothelium in pseudo exfoliation syndrome is unstable, predisposing to an endotheliopathy that is more susceptible to damage during intraocular surgery[54].

He observed the cell density to be decreased, hexagonality of the cells reduced, and an increase in the co-efficient of variation in cell size. Patients with pseudo exfoliation keratopathy are more vulnerable for diffuse corneal decomposition even with the moderate rise in intraocular pressure.

The pathogenetic causes considered are

1. Rise in intraocular pressure.

2. Hypoperfusion of anterior segment due to relative ischaemia.

3. Extracelluar matrix deposition causes membrane destabilization especially between endothelial layer and descement membrane and the cells loses its polarity.

4. Impaired Blood-aqueous barrier results in Iridopathy and alteration in aqueous humour dynamics[27].

In 1993, Schlotzer-Schrehardt and Naumann remarked that the pseudo exfoliation material is produced by the endothelial cells that are focally degenerated[55].

In 1994, Bourne et al studied a progressive decline in endothelial cell density after cataract surgery. This is due to the phenomenon that the human cell continues to transform years after cataract surgery even though the damaged area during lens extraction is healed and recovered[56].

In 1998 Christoper et al studied the corneal endothelial cell changes in pseudo exfoliation syndrome after cataract surgery. He compared the corneal endothelial cells of normal patients with the pseudo exfoliation patients post operatively after the cataract surgery[57].

He concluded that both the groups presented with similar mean endothelial cell reduction. However in the presence of any corneal guttata or glaucoma preoperatively, it adds to the risk of corneal endothelial cell loss. The appearance of guttata in corneal endotheliopathy of pseudo exfoliation patients differ from those seen in Fuchs endothelial corneal dystrophy, pseudophakic or Aphakic bullous keratopathy. The corneal guttata in pseudo exfoliation endotheliopathy are less in number and more diffusely distributed along with melanin dispersion and iris atrophic changes at the pupillary margin[57].

He also added the anterior chamber manipulation in pseudo exfoliation patients with posterior capsular rupture and anterior vitrectomy increases the chance of endothelial decomposition[57].

3. Lens and Zonules [5, 6, 7, 58]:

The most consistent and the most diagnostic finding is the deposition of white flakes on the anterior surface of the lens in a peculiar pattern. On dilating the pupil with a mydriatic "3-ring or target like or eye bull" sign is seen on the anterior lens surface.

The central disc is relatively homogenous corresponds roughly to the diameter of un-dilated pupil. It is a translucent white sheet lying on the anterior pole of the lens capsule. The size varies between 1.5-3 mm.

The central disc is absent in 20% of pseudo exfoliation cases or more. The central part is usually overlooked but with careful examination after dilation, subtle changes can be noted.

The intermediate zone is clear probably due to the contact with the moving iris that rubs off the material.

The peripheral zone is the most consistent finding and it is always present. It is granular with radial striations and has layers. Axially it is bounded by curled edges and partly by tongue shaped projections. Equatorially it extends as a granular tongue shaped projection which merges into the normal capsule before reaching the anterior zone of insertion of the zonular fibres. The peripheral band may be situated close to the equator in some eyes and more axially in others. The granularity is because of undisturbed accumulation of pseudo exfoliation material.

A precursor of pseudo exfoliation material is the pre capsular film initially deposited diffusely on the lens surface. The pre capsular film is homogenous and has a “ground-glass or matte” appearance. The ultra structure study of pre capsular layer shows micro-fibrils similar to pseudo exfoliation material. It is best visualized by placing the slit beam at 45Degree to the axis of observation reducing the light source and focusing temporarily 2-3mm from the centre of the lens.

Clinical classification of Exfoliation syndrome based on morphological alterations of the anterior lens capsule [59]:

Preclinical stage: Usually, clinically invisible

Suspected pseudo exfoliation syndrome

i. **Early suspect** (Electron-microscopy): Precapsular layer.

ii. **Masked/Suspected pseudo exfoliation syndrome**: Posterior synechiae without any obvious cause.

iii. **Mini-Exfoliation syndrome**: Focal defects start supero-nasally.

iv. **Classic exfoliation syndrome**: Late stage.

Several authors studied the 3 zones in the anterior surface of capsule and noticed peripheral band is always present.

In 1987, Ruotsalainen & Tarkkanen reported that there is no variation in thickness of capsule between the pseudo exfoliation patients and non-PEX cataractous lenses[60].

Several studies done by Hiller et al in 1982, Hirvela et al in 1995, Pushka and Tarkkanen in 2001 reported a higher incidence of nuclear cataract in PEX eyes[61].

However Reykjavik Eye study made by Arnarsson et al in 2002 found no relationship between nuclear sclerosis & PEX[62].

Pseudo exfoliation material deposited over the zonules produce weakening of zonules and zonular instability leading on to phacodonesis and lens subluxation[5].

Zonular instability is produced by the following mechanisms:

1. At first, the pseudo exfoliation material produced by the pre-equatorial lens epithelium proliferates through the capsular surface and causes disruption of zonular lamella at its insertion into the anterior lens capsule.

2. Secondly, the zonular attachments are separated from their origin and anchored in the basement membrane of nonpigmented ciliary epithelium.

3. At last, the proteolytic enzymes released from the pseudo exfoliation material disintegrate the zonules.

Thus, leads on to zonular instability, phacodonesis and inferior dislocation of lens[5].

Preoperative evaluation of anterior chamber depth serves as a prognostic indicator for assessing zonular weakness.

In 1994 Ritch proposed loosening of zonules causes dislocation of lens anteriorly with an angle closure attack[63].

4. Ciliary body:

Mizuno and Muroi in 1979 examined ciliary processes clinically. Cycloscopic examination revealed deposition of exfoliative material in the Zonules and Ciliary processes. Gonioscopic examination through a patent basal iridectomy also showed deposition of exfoliative material over ciliary processes.

These changes are detected early before the appearance of pseudo exfoliation material on the anterior surface of the lens capsule.[64]

5. Iris and Pupil:

Pseudo exfoliation material is seen as grey-white flakes at the pupillary margin. The pupillary ruff loses its pigments and has a moth-eaten appearance. The pigments are released into anterior chamber and cause transillumination defects in iris[11].

In 1971 Laatikaanen[65], in 1983 Brooks & Gillies[66] studied the iris angiography in pseudo exfoliation patients and suggested that it shows iris hyper perfusion, peripupillary leakage and neovascularisation.

In 1981 Ringvold & Davanger reported that the vascular abnormalities or the production of abnormal extracellular matrix causes tissue hypoxia[67].

Repo et al in 1993 conversely said hypoxia may be the primary event causing production of pseudoexfoliation material[68].

In 1993 Droslum et al and Asano et al in 1995 proposed Iris hypoxia can lead to atrophy of iris pigment epithelium, Stroma and muscles leading on to poor response to mydriatics. Further, Mardin et al in 2001 suggested the formation of posterior synechiae also restrict the dilation of pupil[69].

The breakage in blood aqueous barrier predisposes to synechial formation between anterior lens capsule and the pigment epithelium of iris.

6. Angle Characteristics[5]:

Gonioscopic findings shows increased meshwork pigmentation which is distributed unevenly. In addition to pigmentation it also has deposition of pseudo exfoliation material.

Apart from trabecular meshwork, pigmentation is also seen in schwalbe line and it is known as Sampolesi line. In eyes with asymmetrical pigmentation, the eye with more pigmentation is more prone for glaucoma. Angle studies on the basis of peripheral anterior synechiae shows 9% to 18% of the angles are occludable and 14% are closed angles.

Trabecular meshwork, Schlemm canal, collector channels serve as site for active exfoliation material production and the intertrabecular spaces remain as the space for deposition of the formed material. Accumulation of the exfoliation material leads to juxtacanalicular meshwork swelling and the architecture of Schlemm canal is lost in advanced cases. Very rarely a pretrabecular sheet of abnormal extracelluar matrix is formed by the proliferation and migration of corneal endothelial cells that covers the uveal meshwork.

In 2000 Vesti and Kivela mentioned the relationship between pseudo exfoliation syndrome and pseudo exfoliation glaucoma[70].

In a study by Drolsum et al, he found 48.9% of eyes with PEX had glaucoma but only 6.8% in eyes without PEX.

7. VITREOUS:

Since hyaluronic acid and pseudo exfoliation material both are acid mucopolysaccharides, vitreous changes do commonly occur. Change in aqueous composition lead to derangement of hyalocyte metabolism resulting in impaired production of hyaluronic acid and liquefaction.

PSEUDO EXFOLIATION AND GLAUCOMA[5]:

Eyes with pseudo exfoliation are at risk for glaucoma. The early manifest glaucoma trial shows eyes with ocular hypertension and pseudoexfoliation are at two times higher risk for the development of glaucoma.

Apart from open angle glaucoma, pseudo exfoliation syndrome also present with angle closure in small number of cases. Also, the patients present with acute rise in intraocular pressure with open angles.

OPEN ANGLE GLAUCOMA[5]:

All the patients with pseudo exfoliation syndrome may not end up with glaucoma at the same time glaucoma can occur in both eyes in patients having unilateral pseudo exfoliation.

This led to the thought of similar mechanism of aqueous outflow obstruction in both chronic open angle glaucoma and pseudo exfoliation glaucoma.

Eyes with pseudo exfoliation are at higher risk of glaucoma, hence a causal relationship between the abnormal exfoliation material and the rise in IOP is established. Further the pseudoexfoliative glaucoma responds poorly to antiglaucoma medications and topical corticosteroids. Hence the possibility of different mechanism causing glaucoma in PEX is established[5].

Local production of exfoliative material from trabecular meshwork, its endothelial cell damage and deposition play a role in rise in intraocular pressure. It is also found that optic neuropathy sets faster in eyes with pseudo exfoliation glaucoma.

This suggests the presence of an intrinsic vulnerability of the optic nerve for the damage to occur.

Even though the disc area and the morphometric features of optic nerve head remains the same, glaucomatous neuroretinal rim involvement is sectoral in chronic open angle glaucoma whereas more diffuse in pseudo exfoliation glaucoma[5].

Also, the Immuno electronmicroscopic studies show the occurrence of elastosis in laminacribrosa suggesting the role of LOXL1gene[5].

ANGLE CLOSURE GLAUCOMA:

In 1988 Gillies W.E. studied 139 cases of pseudo exfoliation syndrome with acute glaucoma. Among these, 86 presented with open angle glaucoma, 21 with neovascular glaucoma and 18 with acute angle closure glaucoma.

The mechanisms causing angle closure glaucoma are Zonular weakness leading to anterior dislocation of lens, thickened lens due to cataract formation, posterior synechiae leading onto increased adhesiveness of iris to lens, degeneration of sphincter muscle and iris rigidity. The anterior chamber depth in angle closure glaucoma is less than 2.2mm[5].

SYSTEMIC MANIFESTATION:

Ultra structural studies, conducted on autopsied specimens suggest pseudo exfoliation syndrome is a multisystem disorder. Pseudo exfoliation material is found in skin, lungs, gallbladder, liver, myocardium, kidney, bladder, cerebral meninges. In eyes it is also found

in extra ocular muscles, orbital septa, posterior ciliary arteries, vortex veins and central retinal vessels. An association of PEX with abdominal aorta aneurysms is studied extensively. The staining of the material in these organs is similar to the staining pattern found in eye. These findings are consistent with an aberrant connective tissue metabolism throughout the body[5].

CATARACT SURGERY IN PSEUDOEXFOLIATION SYNDROME:

Patients with pseudo exfoliation syndrome are more prone for complications during and after surgery. Cataract surgery in pseudo exfoliation syndrome is a challenging surgery because of the two very important risk factors.

1. Poor pupillary dilatation, due to ischaemia of iris and infiltration of exfoliative material into iris which produces obstruction to dilatation mechanically

2. Zonular weakness which is increased in old age, glaucoma, hard cataract

Careful examination of corneal endothelium is mandatory in advanced cases of pseudo exfoliation. A shallow anterior chamber depth should arouse the suspicion of zonular instability[71].

Ultrasonographic biomicroscopy is also very helpful to look for significant zonular weakness and to detect the presence of stretched zonules.

Eyes with pseudo exfoliation are at high risk for posterior capsular rupture, zonular dialysis, intraocular bleeding and vitreous loss intra operatively. The presence of zonular instability increases the risk for dislocation of lens, zonular dialysis and vitreous loss to ten times.

Patients with pseudo exfoliation are at greater risk of developing a rise in intraocular pressure and inflammation in the immediate post-operative period. Pigment deposition in IOL is also seen. Decenteration of intraocular lens is more common even though the lens is placed in the bag due to the malposition of entire bag. Capsular contraction syndrome, if exaggerated, can also lead to intraocular dislocation. Secondary cataract is more common because of aggravated blood-aqueous barrier breakdown[72].

In 1987 Skuta G.L, Parish R.K et al observed an increased incidence of zonular dialysis during cataract surgery in patients with pseudo exfoliation syndrome. They also attributed an asymmetrical anterior chamber depth, preoperative phacodonesis and excessive

movement of lens during capsulotomy should alert the suspicion of zonular dialysis[73].

Various studies made by Goder and Rechlin in 1988, Puska et al in 2000, Inazumi et al in 2002, Guo et al in 2006 regarding the use of more sophisticated procedures like scheimpflug photography, ultrasound biomicroscopy observed that they are very helpful in diagnosing zonular weakness.

In 1989 Naumann G.O, Kuchle M, Schonherr U noted increase in vitreous loss to seven fold in patients with pseudo exfoliation syndrome undergoing cataract surgery[74].

In 1999 Wang L, Yamasita R et al observed the eyes with pseudo exfoliation syndrome with specular microscopy and quantified the aqueous flare with laser flare cell meter. Corneal endothelial cell density is significantly reduced in eyes with pseudo exfoliation syndrome and an inverse correction was shown with flare. An association of decrease in corneal endothelial cells and disruption of blood-aqueous barrier is made[75].

In 1997 Kuchle M, Naumann H et al conducted a study and presented that the patients with pseudo exfoliation syndrome are frequently associated with impaired blood aqueous barrier. This is responsible for having higher frequency of after cataract postoperatively[76].

In 1993, Lumme P. Lattikaanen L studied 351 patients with pseudo exfoliation undergoing cataract surgery. He observed that the prevalence of pseudo exfoliation is more in patients aged greater than 70 years. He also mentioned that the intraoperative risk is more, either directly due to rupture of zonules or indirectly due to poor dilation of pupil. The vitreous loss increased in these patients to four fold and the need to use an anterior chamber intraocular lens to tenfold[77].

In 1988, Hovding reported 17.9% capsule or zonular breaks in pseudo exfoliation patients who underwent extra capsular cataract extraction whereas it is only 5.6% in non- pseudo exfoliation eyes.

In 1998 Scrolloli et al emphasized that PEX patients develop intraoperative complications five times more than non-PEX patients[78].

In 2000, Morena et al reported that poor dilatation, irido-phacodonesis and presence of glaucoma are associated with posterior capsular rupture during cataract surgery.[79]

In 2000, Kuchle et al noted that an anterior chamber depth of less than 2.5mm pre-operatively indicates zonular instability and should alert the surgeon of intraoperative complications[80].

In 1994, Freyler H. Radax U compared extra capsular cataract surgery with phacoemulsification. He noted miosis and phacodonesis were the two important risk factors. Phacoemulsification was noted to be superior than extra capsular cataract surgery and had significantly lesser complications[81].

In 1966 Stanila A studied the intraoperative and post-operative complications in pseudo exfoliation patients undergoing cataract surgery. He noted poor pupillary dilatation, posterior capsular tears, loss of vitreous and rise in post-operative intraocular pressure and high chance of posterior capsular opacification[82].

In 2002 Vickie Lee and Anthony Maloof emphasized that a CTR stabilizes the capsular bag by redistributing forces. Thereby CTR produces tautness of bag which gives a counter traction while operating. CTR is useful in zonular dialysis of less than 5 clock hours. CTR should be inserted at right time during the surgery to avoid the intraoperative complications, usually after doing a capsulorhexis but before hydrodissection[83].

In 2004 Albert Garland MD et al studied the pathophysiological alterations associated with pseudo exfoliation, its intraoperative consequences and the considerations for surgical and intraocular lens modifications. They noted the poor pupillary dilatation to be an important risk factor and suggested, it can be managed by using high viscosity viscoelastic agents and iris hooks. Sphincterotomy, the most widely performed technique even now days was cautioned since it could cause a persistent dilatation and hence cosmetically not accepted. They suggested that the usage of hydrophobic acrylic and silicon lens lowers the rate of posterior capsular opacification[84].

In 2008 Howard Fine reported "CTR can convert a high risk case into a routine case". The principle behind the usage of CTR is that it has got a ring diameter larger than capsular diameter and the centrifugal force created is distributed equally throughout the zonular apparatus circumferentially. In case of advanced zonular dialysis more than 5 clock hours with overt subluxation capsular tension segments can be used. It is 120 degrees, a partial CTR. A very loose bag can be supported with two CTS[85].

MANAGEMENT OF CATARACT SURGERY IN PSEUDO EXFOLIATION SYNDROME:

Cataract surgery in patients with pseudo exfoliation requires special attention

1. Careful and detailed pre-operative evaluation.
2. A well planned surgical strategy.
3. Closer follow-up postoperatively.

1. Detailed preoperative evaluation:

To avoid intraoperative surprises and to choose a surgical plan, a detailed preoperative evaluation is mandatory. It includes

- Check the visual acquity and find if there is any discrepancy between the lens changes and visual acquity.
- Assess for the presence of potential glaucoma.
- Under slit lamp look for the direct instability signs such as Phacodonesis, Iridodonesis, Subluxation of lens
- Also look for indirect signs of instability such as any significant change in the depth of the anterior chamber (shallow, deep or irregular)

- ❖ Do a dilatation test and check the status of the optic nerve
- ❖ In advanced cases also a specular microscopy to study the corneal endothelial cells.

2. Well Planned Surgical Strategy:

Each eye is different and based on it the surgical considerations should be modified.

a. Incision:

A temporal approach is more advisable, since the zonular instability starts mostly in the superior area[71].

In phacoemulsification, a clear corneal incision at the temporal periphery is usually preferred for the following reasons

- ➢ This approach saves the superior location for filtration surgery in future, if needed
- ➢ Cornea being an avascular plane less chance of fibrinoid reaction in anterior chamber[86].

b. Ophthalmic Viscosurgical Devices:

The OVD we use should serve two important purposes

- Stay for a longer time
- To protect the corneal endothelium

Also, care should be taken not to over pressurize the chamber since it may lead on to further damage of the zonules.

To address the above requirements, soft shell technique, which utilizes the usage of two OVDs, a cohesive and a dispersive will serve as a good option[71].

c. Maximum pupillary dilatation:

i. PHARMACOLOGICAL METHODS:

The use of pharmacological methods such as Adrenaline or Phenylephrine intracamerally is of little or no use

ii. NON-PROSTHETIC METHODS:

It includes the usage of

- Viscomydriasis
- Iris stretching manually

- Iris microsphincterotomies
- Sector iridectorny

The advantage of non prosthetic methods is less instrumentation but it makes the iris atonic after manipulation and it is very difficult to do phacosurgery[83].

iii. PROSTHETIC METHODS:

A wide range of rings and dilators are available which can be used according to the preference of the operating surgeons. It includes

1) Iris hooks
2) Malyugin ring
3) Beehler pupil dilator
4) Dilation ring
5) Y – hooks
6) Special dilating forceps

The prosthetic devices confer more effective iris control. Flexible iris hooks are used initially for enlarging the pupil and then for stabilizing the anterior capsule thereby it prevents the posterior subluxation of lens[83].

Beehler pupil dilator can be used for small pupils. It stretches upto 6-7mm at the cost of microsphincterotornies around the pupillary margin circumferentially[86].

However pupil stretched by this manner retains a good cosmetic appearance. Sometimes it may require miotics to prevent synechias to the capsulorhexis margin.

In 2004, Akman et al compared Y- hooks, pupil dilator polymethyl methacrylate rings, iris retractor hooks, and special dilating forceps. He found all were equally promising. He noted iris retractor hooks and PMMA pupil dilating rings were time consuming. Of all, dilation ring proved to be the most promising since it caused least trauma.

All the pupillary maneuvers produce an altered blood aqueous barrier, hence as long as we can operate safely; it is not advisable to alter the pupil.

d. Anterior Capsulotomy:

Previously used anterior capsulotomy techniques such as can-opener or envelope techniques are more risky since the torn capsule can readily run peripherally and lead on to posterior capsule rupture and

vitreous loss. Nowadays, performing continuous curvilinear capsulorhexis has become a routine[87].

In a study conducted by Shastri and Vasavada in 2001, it was found that the CCC can be performed in PEX eyes in a similar fashion as in non PEX eyes.

Capsular fibrosis, its fragility and zonular weakness makes the initiation and completion of the capsulorhexis very difficult. The usage of dyes like Trypan blue and Indocyanine green helps to stain the capsule well and allows better visualization. While staining "Sweeping technique" is recommended[83]. Here we inject a few drop of dye (trypan blue) under ophthalmic viscosurgical devices and this is spreaded with a spatula over the anterior capsule. This technique prevents the dye from entering into the vitreous cavity through an impaired area[71].

A successful capsulorhexis requires the following approach.

1. Avoid over inflation of the anterior chamber with viscoelastics which may further unzip the zonular weakness.

2. Assess the zonular weakness gently by putting a blunt instrument over the lens and rock it to & fro smoothly.

3. An excessive movement of the lens during CCC should arouse the suspicion of zonular weakness.

4. Use a sharp tip to start with CCC, since already the weak zonules offer a poor resistance to perform CCC

5. Look for any wrinkling of anterior capsule while performing CCC. The wrinkles indicate the presence of loose zonules. Multiple grasps will help in completing the CCC successfully[87].

CCC should not be too small or too large. If too small, it adds further stress to weak zonules and if too large, zonular attachment can get engaged resulting in PCR and vitreous loss. Ideal CCC should be 5.5-6mm. Atleast 6mm since the large capsulorhexis leaves back less lens epithelial cells[86].

If unable to do an ideal capsulorhexis, perform it at the end of surgery or do Nd-YAG laser relaxing capsulotomy within the first month (immediate post-operative period).

Two handed capsulotomy technique described by Neuhann is an excellent alternative. It makes use of tangential force. One hand holds the flap with a forceps through main incision and exerts a slight backward traction whereas the other hand advances the torn edge tangentially.

This is more important since the small capsulorhexis will harbor a large amount of lens epithelial cells which further undergoes metaplasia leading onto capsular fibrosis post operatively[71].

e. Hydrodissection and hydrodelineation

Hydrodissection, isolates cortex from the capsule and forms one of the mandatory step. The advantage is it reduces the chance of zonular damage.

Ideal Hydrodissection should be done in the following procedure:

1. It is important to remove some viscoelastic substances before performing hydrodissection. This simple idea minimizes the excessive pressure in anterior chamber. It is done by pressing the lowerlip of the incision with the cannula.

2. As mentioned by Vasavada, Hydrodissection should be performed in all quadrants (3 or 4 areas), since this would help in redistributing the stress throughout the bag.

3. Hydrodissection is not complete unless we see the BSS coming out of the capsular bag.

4. Performing hydrodelineation is very useful since it produces an epinuclear shell which acts as an additional safeguard[71].

f. Extraction of lens nucleus/phacoemulsification

A study conducted by Hyams et al in 2005 stated, the rate of intraoperative complications is much lower in phacoemulsification than in ECCE. This is confirmed by others [Dosso et al 1997, Shastri & Vasavada 2001, Nagashima 2004]

Increased force needed for extraction of lens nucleus through a relatively miotic pupil raises the intraoperative complications during ECCE, whereas in phacoemulsification gentle manipulation is done[87].

g. Management of zonular weakness

Capsular Ring:

This is a very useful device and helps in distributing the traction equally in the presence of loose zonules (Hara et al 1991; Hasanee et al 2006).

Also it should be noted that CTR will not always prevent an increase in subluxation. Similarly neither it prevents postoperative capsular contraction nor in the bag dislocation of IOL.

Ideal time of CTR implantation during surgery should be individualized. Some surgeons prefer it to use immediately after hydrodissection whereas some just after removing the epinucleus and cortical remnants[71].

In 2001 Bayraktar, et al reported that the usage of CTR before phacoemulification minimizes the risk of zonular dialysis in PEX eyes. He also added if CTR is correctly placed just beneath the capsule it avoids entrapment of cortical material by the CTR.

In 2005 Ahmed, et al reported early implantation of CTR is hazardous. It can increase the capsular torque significantly and lead on to displacement.

However CTR can be implanted immediately when there is an increased zonular weakness independent of the phase of surgery.

Various signs that arouse the suspicion of zonular weakness are

- Difficulty in rotating the nucleus or fragments freely.
- Localisation of the subluxated area.
- Ovalisation.
- More flaccidity of the rhexis edges.

The important technique in implanting CTR is, it should be started in the direction of maximum instability. CTR can be used in less than five clock hours of zonular weakness[71].

In greater degrees of zonular weakness a new ring is designed with an eyelet for sclera fixation or else can use capsular retractors to hold the capsule[83].

h. Irrigation & aspiration:

Abundant cortex and poor pupil dilation possess a high stress over zonules. Aspiration with tangential movements lessens the zonular stress. If, any areas of zonular dehiscence the cortical material should be removed by striping tangentially towards the dehiscence[71].

i. Anterior capsular polishing

It is done to reduce the anterior capsular contraction postoperatively. The central 6mm of anterior capsule is removed where there are more lens epithelial cells.

j. Choice of intraocular lens:

To have a greater biocompatibility, lens with following features should be used

1. Hydrophobic acrylic optic with 3 piece PMMA to minimize the potential inflammation.

2. Square edged to minimize the possibility of posterior capsular opacification.

3. Use heparin coated IOL's.

4. Avoid plate haptic foldable silicone IOL's.

5. Evaluate lens implant stability by Bounce test. This is done by voluntarily decentering and releasing the IOL. It should fall back to its original position (spontaneous recenteration).If not, remove, reposition and reevaluate.

In occurrence of PCR, lens can be placed in the ciliary sulcus if there is an adequate capsular support.

In cases if there is no capsule, Iris-claw IOL or Scleral fixated IOL can be used[71, 87].

3. Follow-up:

Post operative complications have an insidious onset; hence a careful and regular follow-up is mandatory[71].

Early Complications:

a) Postoperative Inflammation:

Due to blood-aqueous barrier breakdown postoperative inflammation is common and it depends on the iris trauma.

Earlier, the inflammatory response, posterior synechiae was relatively high in PEX patients.

Now phacoemulsification being a standard procedure causes less iris trauma and hence post operative inflammation has come down[87].

b) Pressure Spikes:

Various studies conducted by various authors showed a rise in IOP postoperatively.

Washing out the viscoelastics thoroughly at the end of surgery is of prime importance to reduce the possibility of rise in IOP.

A prophylactic treatment can be given to high-risk cases to combat the rise in IOP postoperatively.

In 1987 Handa, et al found a reduction in IOP in some PEXG patients. In 2003 Shingleton, et al argued the reason for reduction in IOP in some PEX patients is due to washout of pseudo exfoliation deposits thereby improving the outflow.

Recently, now in 2014 V. Tao Tran proved washout of pseudo exfoliation material combined with cataract surgery lowers the IOP in PEX eyes[87].

C) Corneal Edema:

The presence of corneal guttata preoperatively raises the endothelial cell loss postoperatively resulting in corneal edema and corneal decompensation[57].

D) Capsular contraction sundrome:

It occurs within a month. An imbalance between the peripheral weakness and a central contractile force causes a capsular fibrosis. This can be avoided by performing

- Optimal anterior rhexis or secondary capsulorhexis.
- Vacuuming the undersurface of anterior capsule intra operatively prior to IOL implantation.

- Using rigid PMMA haptics.

Capsular fibrosis leads on to displacement of IOL and zonular dehiscence[71, 86].

Late complications:

1. **Spontaneous dislocation of lens**:

This is due to progressive zonulopathy. It takes at least 7 years. The capsular ring does not prevent it and it is mandatory to do a sclera fixation of IOL.

2. Posterior capsular opacification

The occurrence is high in patients with

- Post operative inflammation
- Incomplete AC wash, with cortical remnants
- Impairment of blood-aqueous barrier
- Hypoxia
- Zonular weakness

Nishi, et al in 2004, Dewey in 2006 reported that there is a significant reduction in posterior capsular opacification due to improvement in IOL designs and surgical techniques[86].

AIM OF THE STUDY

1. To study the risk factors leading to intra-operative complication in patients with pseudo exfoliation undergoing cataract surgery.

2. To determine the intra-operative and postoperative complications in patients with pseudo exfoliation syndrome undergoing cataract surgery.

RESEARCH METHODOLOGY

STUDY DESIGN:

A hospital based cross-sectional study.

SETTING:

Study was done at Department of Ophthalmology, Coimbatore Medical College Hospital, Coimbatore.

DURATION OF STUDY:

From August 2013 to July 2014

STUDY POPULATION:

Patients who attended the Ophthalmology OPD and inpatients with pseudo exfoliation syndrome and cataract were included in the study based on selection criteria. About 50 patients were included in the study.

INCLUSION CRITERIA:

Pre-senile and senile cataract patients with pseudo exfoliation in one or both the eyes were included in the study.

EXCLUSION CRITERIA:

The study excludes

1. All patients with glaucoma including known pseudo exfoliation glaucoma and increased IOP
2. Developmental, Juvenile, Traumatic cataract
3. Previous h/o trauma
4. Previous h/o intraocular surgeries
5. Systemic conditions predisposing to subluxation of Lens
6. Uveitis
7. Posterior segment pathology

STUDY METHODS:

Verbal consent was obtained from the patients selected for study. Data collected using structured questionnaire which comprises socio demographic characteristics like age, sex, occupation & detailed history.

Clinical Examination includes

1. Visual Acuity testing for distant and near objects by using snellen's chart for distant and near respectively

2. Refraction

3. External ocular examination

4. Slit Lamp Bio microscopy

To look for the following evidences:

- Presence of pseudoexfoliation along the pupillary margin, iris surface and anterior surface of the lens
- Morphopathological changes in cornea
- Breakdown in blood aqueous barrier
- Irregular/ shallow anterior chamber depth
- Pigment dispersion in anterior chamber
- Iridodonesis
- Phacodonesis with Subluxation/Dislocation of lens
- Posterior synechiae
- Measurement of pupillary size before and after dilatation
- Pupillary reaction
- Type of cataract (nuclear, posterior subcapsular cataract, cortical Cataract)

Van Herick method for anterior chamber angle assessment[7]

PACD proportion to CT	Grade	Description	Comment
> 1	4	Peripheral anterior chamber space equal to full corneal thickness or larger.	Wide open
1/4-1/2	3	Space between one-fourth and one-half corneal thickness.	Incapable of closure
1/4	2	Space equal to one-fourth corneal thickness	Should be gonioscoped
<1/4	1	Space less than one-fourth corneal thickness	Gonioscopy shows dangerously narrowed angle.

1. Intra ocular pressure measurement using Goldmann Applanation tonometry.
2. Gonioscopy with the help of Goldmann single mirror. The patients with pseudoexfoliation were carefully evaluated and graded according to their findings.

Grading of Angle width (Shaffer's grading)[7]:

Grade	Angle width (degrees)	Configuration	Structure seen on gonioscopy	Chance of closure
4	35-45	Wide open	From Schwalbe's line to Ciliary body	Nil
3	25-35	Open	From Schwalbe's line to Scleral spur	Nil
2	20	Moderately narrow	From Schwalbe's line to Trabecular meshwork	Possible
1	10	Very narrow	Schwalbe's line only	High
0	0	Closed	None of the structures are visible	Closed

Grading of Trabecular meshwork pigmentation

Grade 0	NIL
Grade 1	Faint
Grade 2	Average
Grade 3	Moderate
Grade 4	Heavy

Patients were noted for the presence of sampolesi's line.

1. Fundus Examination
2. Pupillary measurement before and after full dilatation
3. Keratometry
4. A-scan and power calculation for intra ocular lens
5. Lacrimal patency test
6. Urine sample for sugar
7. Random Blood sugar
8. ECG
9. If Diabetic, Fasting and post prandial blood sugar and Diabetologist opinion regarding fitness for cataract surgery
10. If Hypertensive, Pysician opinion regarding fitness for cataract surgey
11. If Cardiac patient, ECG, and Cardiologist opinion regarding fitness for cataract surgery
12. Last but not least rule out any septic foci elsewhere in the body

PRE-OPERATIVE CARE:

Prior to the day of surgery, Injection TT 0.5ml, Test dose of Lignocaine was given. On the day of surgery, pupils were dilated with Tropicamide 0.8% and phenylephrine 5%. One drop for every 15 minutes one hour before surgery till the pupil was adequately dilated. To prevent the intra operative constriction of pupil non steroidal anti-inflammatory drugs like Flurbiprofen 0.03% was instilled one drop every 15 min. A written consent was obtained from the patient for cataract surgery.

LOCAL ANAESTHESIA:

A peribulbar block was given to obtain intra ocular anaesthesia and analgesia. The constituents of peribulbar block include 2% lignocaine, 0.75% Bupivacaine, Adrenaline 1:200,000, Hyaluronidase 5mg/ml. A 25 guage disposable needle attached to a 5 ml syringe was used. The patient was made to lie down in supine position and asked to look steadily straight ahead. The needle was inserted at the junction of middle two-thirds and lateral one-third of lower eye lid along the floor of the orbit. The syringe was withdrawn and checked for any inadvertent entry into blood vessel. Second injection was given just inferomedial to supraorbital notch. One drop of 5% povidone drop was instilled into the conjunctival sac.

SURGICAL TECHNIQUE:

1. The eye to be operated was painted with povidone and draped under strict aseptic precautions
2. Universal eye speculum was applied
3. Superior rectus (bridle suture) was applied to fix the eye in down gaze
4. A fornix based conjunctival flap was made
5. Underlying Tenon's capsule was cut
6. Perfect haemostasis achieved by applying gentle and adequate cautery
7. A 6-7mm self sealing sclera-corneal tunnel incision made 2mm from limbus using an 11-blade. Thickness should be ½ of scleral thickness
8. With the crescent blade scleral lamellae was dissected and tunnel created
9. Tunnel extended into cornea for 2mm
10. A 2.8mm Keratome was used to create an internal opening

11. A side port was created 90 degree away from the tunnel

12. Air was injected to form the anterior chamber followed by tryphan blue

13. Tryphan blue stains the anterior capsule and after a few seconds it was washed away

14. Anterior chamber was filled with viscoelastic (2% hydroxyl propyl methyl cellulose)

15. Ideal size of Capsulorhexis of about 6mm was made using 27 gauge needles

16. Using 3.2mm extending knife the internal lip of tunnel was extended

17. Careful hydrodissection was done to separate cortico-nuclear mass from posterior capsule

18. If, the pupil was not adequately dilated a manual stretching or sphincterotomy can be done depending on the decision of operating surgeon

19. Synechiolysis can be done if present

20. Nucleus was removed

21. Cortical material was removed by irrigation and aspiration

22. In case of posterior capsular rent, the integrity of the capsular bag was assessed to place the IOL

23. In case of vitreous loss, anterior vitrectomy was done

24. If the posterior capsule was intact IOL was placed inside the bag

25. The remaining viscoelastic was washed from the anterior chamber

26. Sub conjunctival Gentamycin & Dexamethasone injection given

27. Pad and bandage applied

Post operatively vision, Intraocular pressure measurement with a non contact tonometer was done. All the patients were examined under slitlamp examination for the presence of early post operative complications such as corneal edema, Inflammation, retained cortical material, hypema, decenteration of IOL, pigment dispersion over IOL. Topical antibiotic with steroid eye drop was given to all the patients. Systemic Antibiotics was given for 5 days. Patients were advised to come for regular post operative check up. First visit was one week after post operative day. Subsequent visits once in a fortnight till 45 days.

RESULTS AND OBSERVATION

Table 1.

Age Distribution:

Age(yrs)	Frequency	Percentage
50-60	8	16
61-70	23	46
71-80	17	34
81-90	2	4

Figure 1
Age Distribution

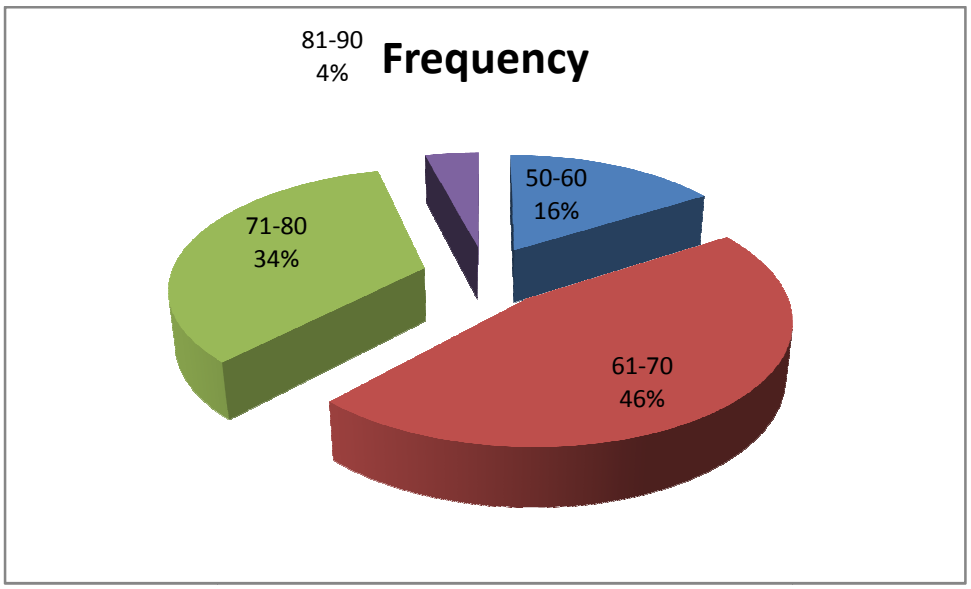


Table 1 shows the age distribution of Pseudo exfoliation. 8(16%) patients were of age group between 50-60years. 23(46%) patients were of age group between 61-70 years.17(34%) patients were of age group between 71-80 years. 2(4%) patients belonged to the age group of 81-90 years.

Table 2.

Sex Distribution:

Sex	Frequency	Percentage
Male	31	62
Female	19	38

Figure – 2 Sex Distribution

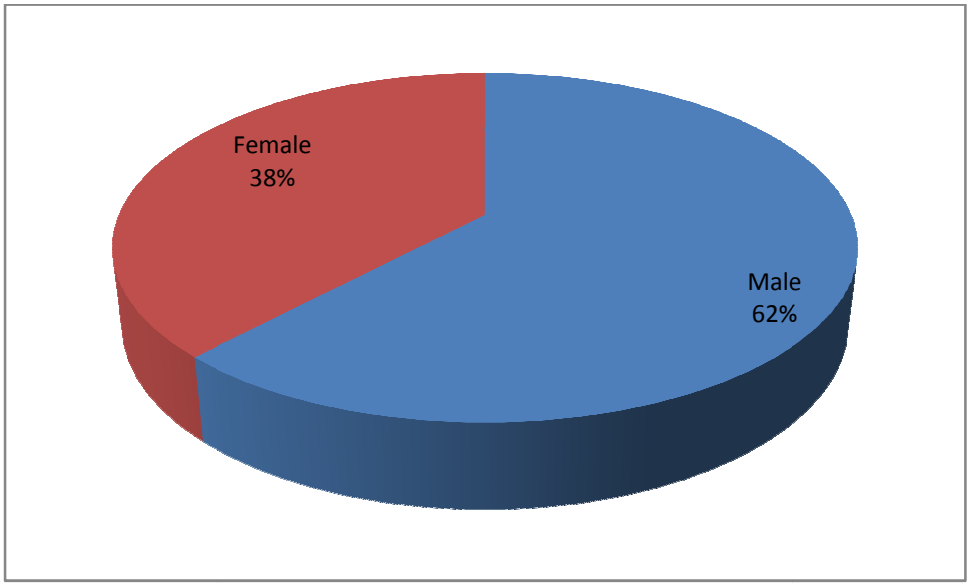


Table 2 shows the Sex Distribution of Pseudoexfoliation. 31(62%) patients were males.19(38%) patients were females.

Table 3

Laterality

Laterality	Frequency	Percentage
Bilateral	28	56
Unilateral	22	44

Figure – 3

Laterality:

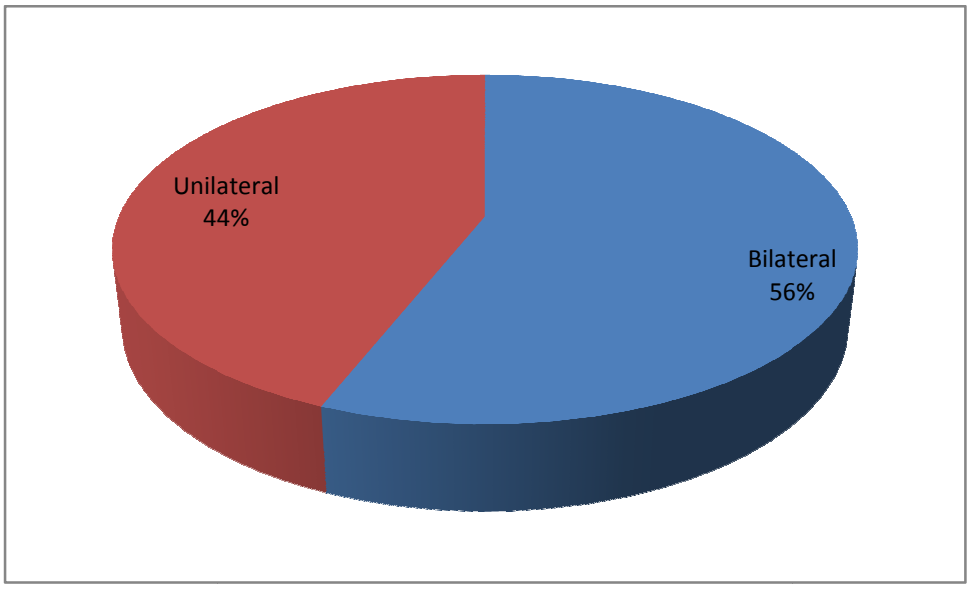


Table 3 shows Laterality distribution of pseudo exfoliation. 22(44%) patients had the presence of pseudo exfoliation material unilaterally. 28(56%) patients presented with bilateral distribution.

Table 4

IOP Range

IOP (range in mm Hg)	Frequency	Percentage
11-13	2	4
13-15	11	22
15-17	2	4
17-19	24	48
19-21	11	22

Figure 4

IOP Range:

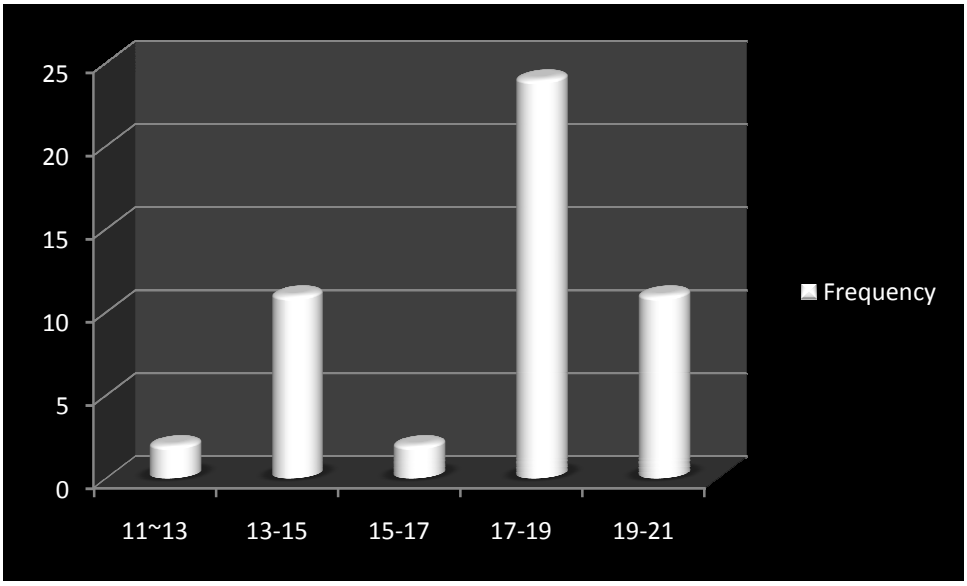


Table 4 shows the range of IOP in Pseudoexfoliation patients. 2(4%) patients had an IOP of range 11-13mmHg. 11(22%) patients had an IOP between 13-15mmg. 2(4%) patients had an IOP between 15-17mmHg. 24(48%) patients had an IOP between 17-19mmHg. 11(22%) patients had an IOP of range 19-21mmHg.

Table 5

Systemic Association

Systemic Association	Frequency	Percentage
Diabetes mellitus	3	6
Hypertension	11	22
IHD	2	4
Others	0	0

Figure 5

Systemic Association

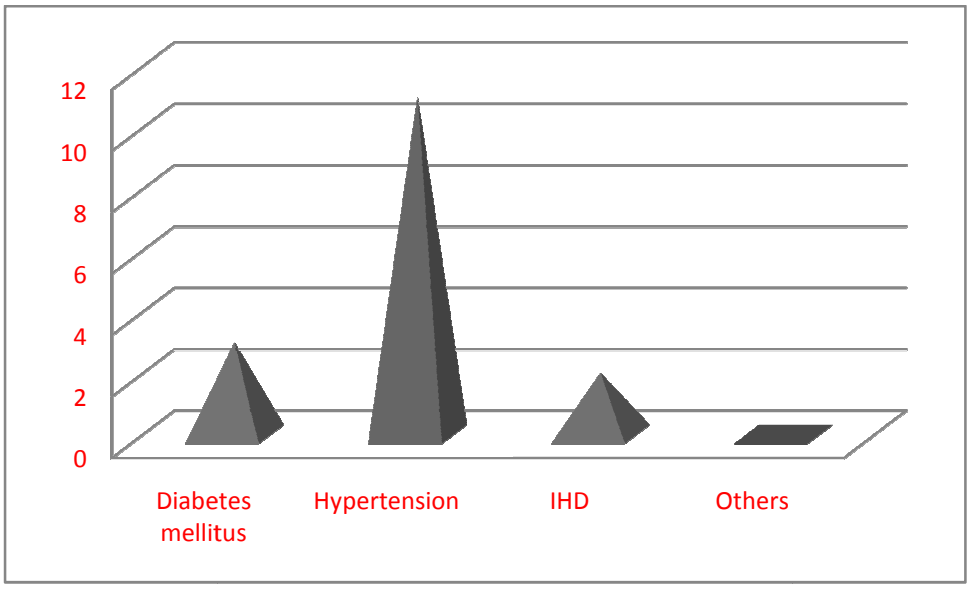


Table 5 shows Pseudoexfoliation & its Systemic association. 3(6%) patients had an association of Diabetes mellitus. 11(22%) patients had an association with Hypertension. 2(4%) patients had an association with Ischaemic Heart disease.

Table 6

Iris characteristics

PXF	Frequency	Percentage
Pupillary Margin	47	94
Iris surface	15	30
Iris atrophy	11	22
Iridodonesis	3	6
Associated Posterior synechiae	10	20

Figure 6

Iris characteristics

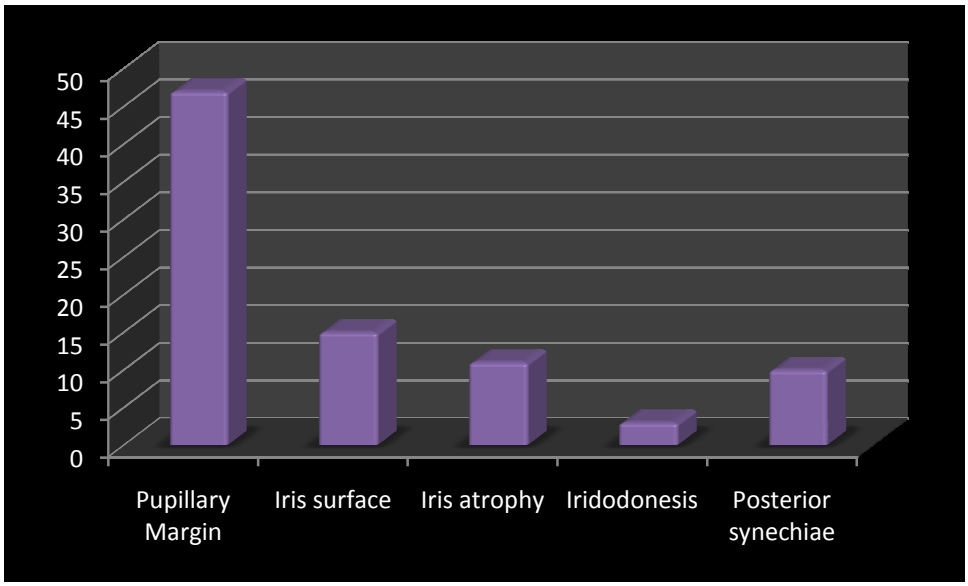


Table 6 shows the Iris Characteristics in Pseudoexfoliation. 47(94%) patients had PXF along the pupillary margin. 15(30%) patients had PXF along the iris surface. 11(22%) patients had Iris Atrophy. 3(6%) had Iridodonesis. 10(20%) patients had posterior synechiae.

Table 7

Pupil diameter after dilation

Pupil diameter (mm)	Frequency	Percentage
2-4	10	20
5-6	25	50
>6	15	30

Figure 7

Pupil diameter after dilation

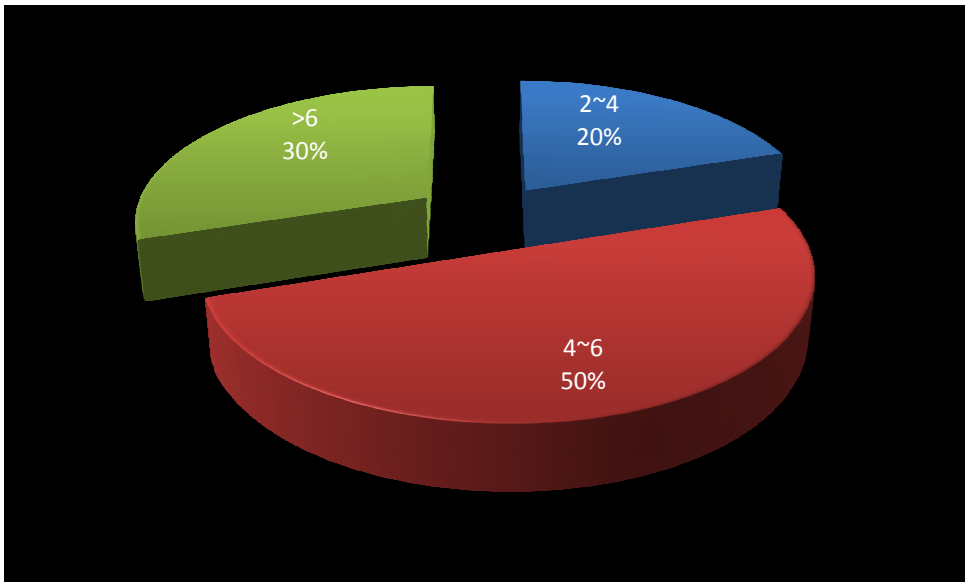


Table 7 shows Pupillary diameter after dilation.10(20%) patients had poor pupillary dilation of 2-4 mm.25(50%)patients had fair pupillary dilation of 5-6mm. 15(30%) had good pupillary dilation of >6mm.

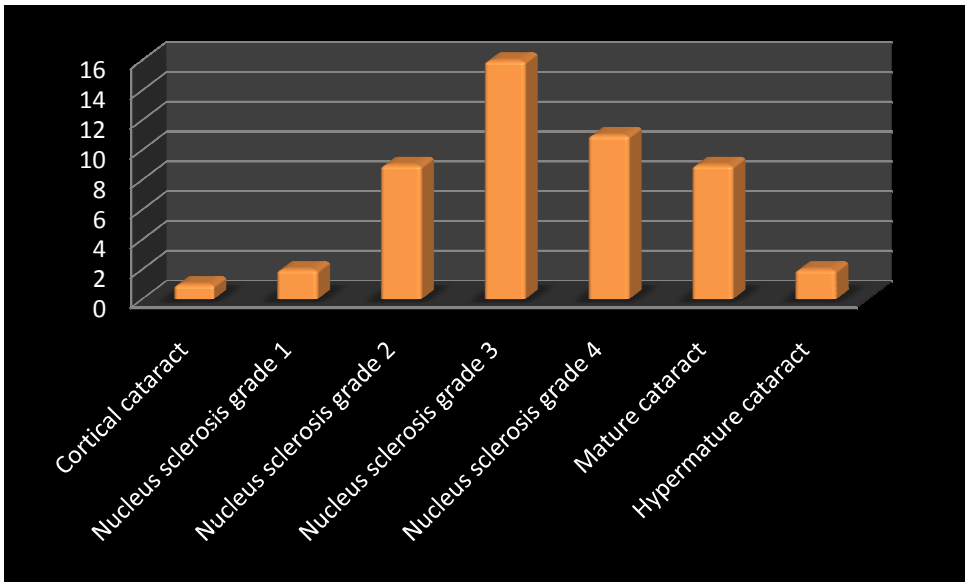
Table 8

Type of cataract:

Type of cataract	Frequency	Percent
Cortical cataract	1	2.0
Nucleus sclerosis grade 1	2	4.0
Nucleus sclerosis grade 2	9	18.0
Nucleus sclerosis grade 3	16	32.0
Nucleus sclerosis grade 4	11	22.0
Mature cataract	9	18.0
Hypermature cataract	2	4.0
Total	**50**	**100.0**

Figure 8

Type of cataract



As shown in table 8, in our study 1(2%) had cortical cataract, 2(4%) had NS grade I, 9(18%) had NS grade II, 16(32%) had NS grade III, 11(22%) had NS grade IV, 9(18%) had mature cataract and 2(4%) had hyper mature cataract.

Table 9

Pre-op risk factors

	Frequency	Percentage
Phacodonesis	4	8
Subluxation/dislocation	2	4
Zonular dialysis	4	8

Figure 9

Pre-op risk factors

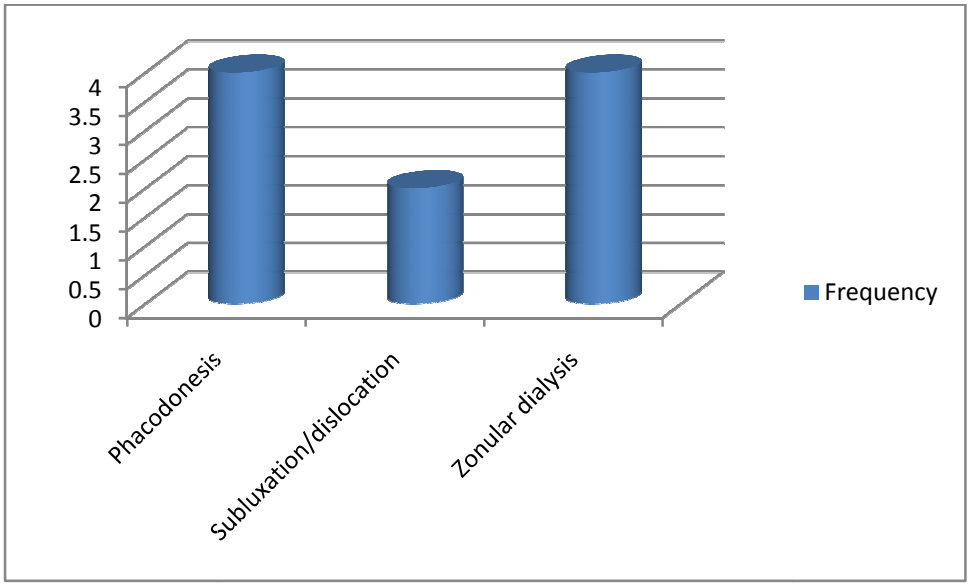


Table 9 shows Pre-operative risk factors. 4(8%) patients had Phacodonesis, 2(4%) had Subluxation/Dislocation of lens, 4(8%) patients had Zonular dialysis.

Table 10

Difficulty in Capsulotomy

Difficulty in Capsulotomy	Frequency	Percentage
Yes	11	22
No	39	78

Figure 10

Difficulty in Capsulotomy

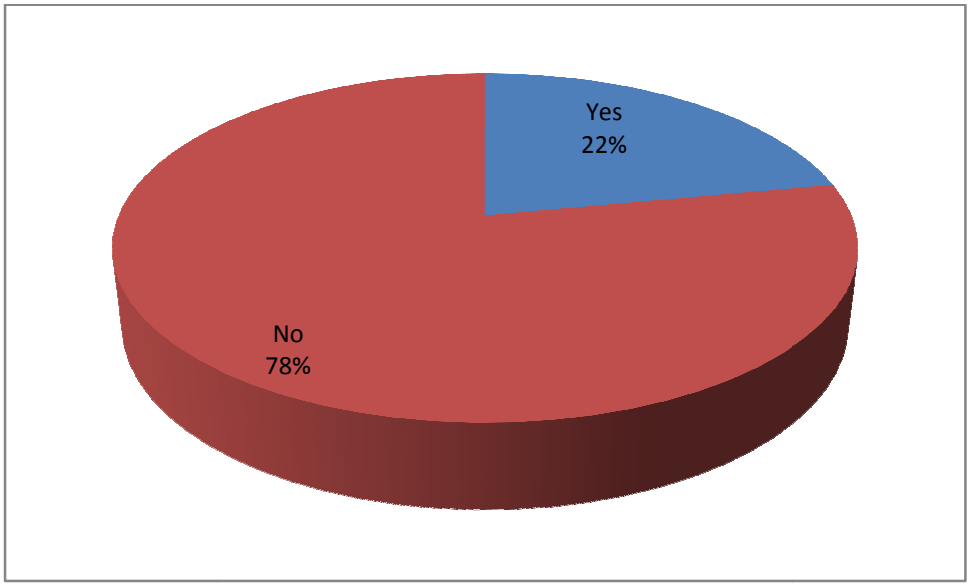


Table 10 shows the Frequency of Difficulty in Capsulotomy. 11(22%) patients had difficulty in capsulotomy. 39(78%) patients had no difficulty in capsulotomy.

Table 11

Difficulty in Nucleus Delivery

Difficulty in Nucleus delivery	Frequency	Percentage
Yes	5	10
No	45	90

Figure 11

Difficulty in Nucleus Delivery

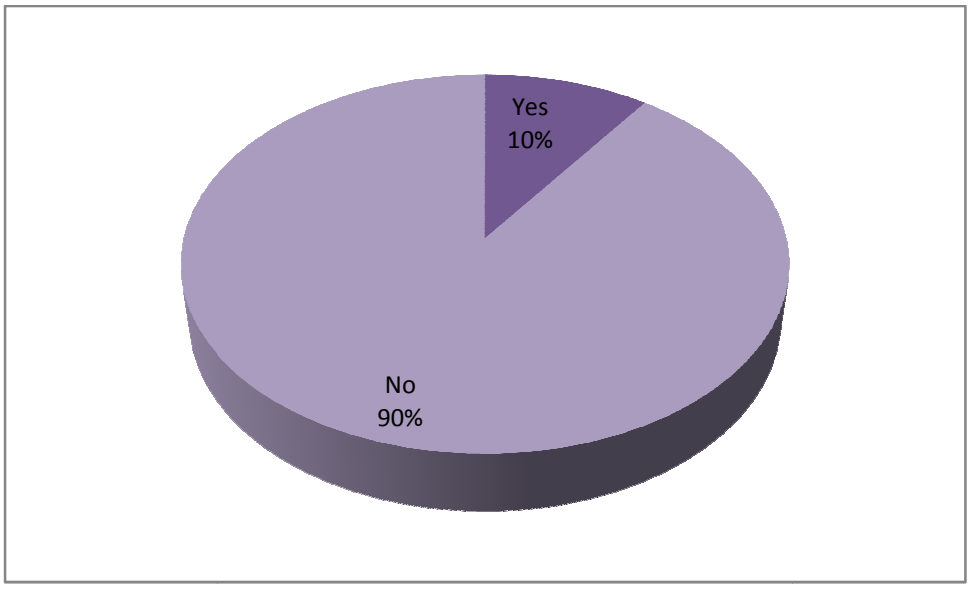


Table 11 shows the Frequency of Difficulty in Nucleus Delivery. 5(10%) patients had difficulty in Nucleus delivery. 45(90%) patients had no difficulty in nucleus delivery.

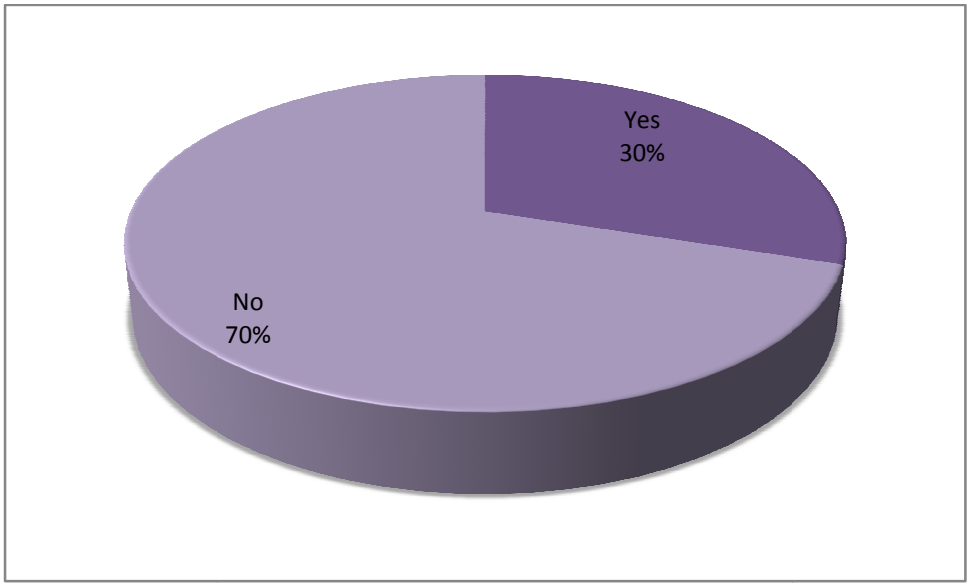
Table 12

Sphincterotomy

Sphincterotomy done	Frequency	Percentage
Yes	15	30
No	35	70

Figure 12

Sphincterotomy



As shown in table 12, in our study 15 (30%) patients had multiple sphincterotomy done among 50 patients.

Table 13

PXF on TM

PXF on TM	Frequency	Percentage
Absent	19	38.0
Present	31	62.0

Figure 13

PXF on TM

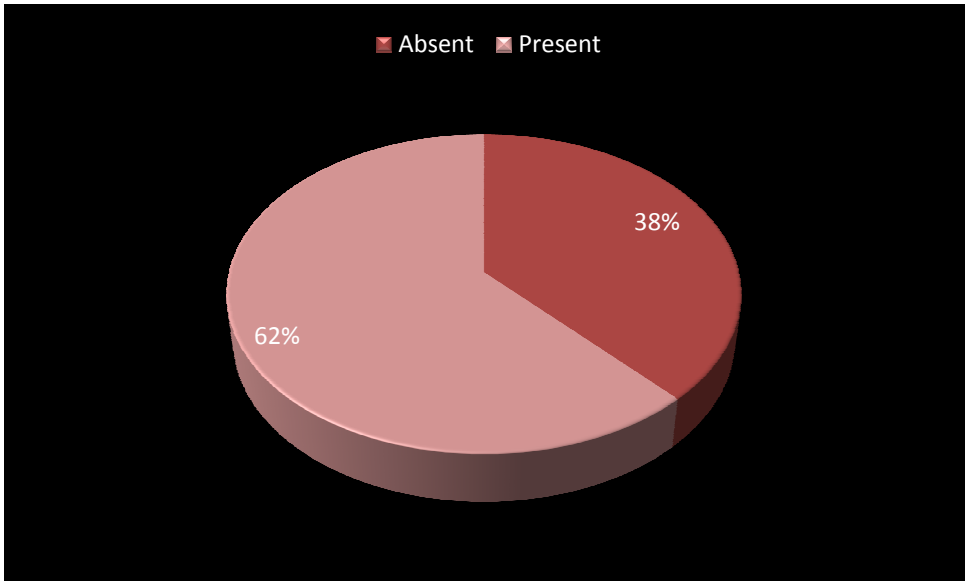


Table 13 shows, in our study 19(38%) patients had pseudo exfoliation material on Trabecular meshwork.

Table 14

Zonular dialysis

Zonular dialysis	Frequency	Percentage
Yes	8	16
No	42	84

Figure 14

Zonular dialysis

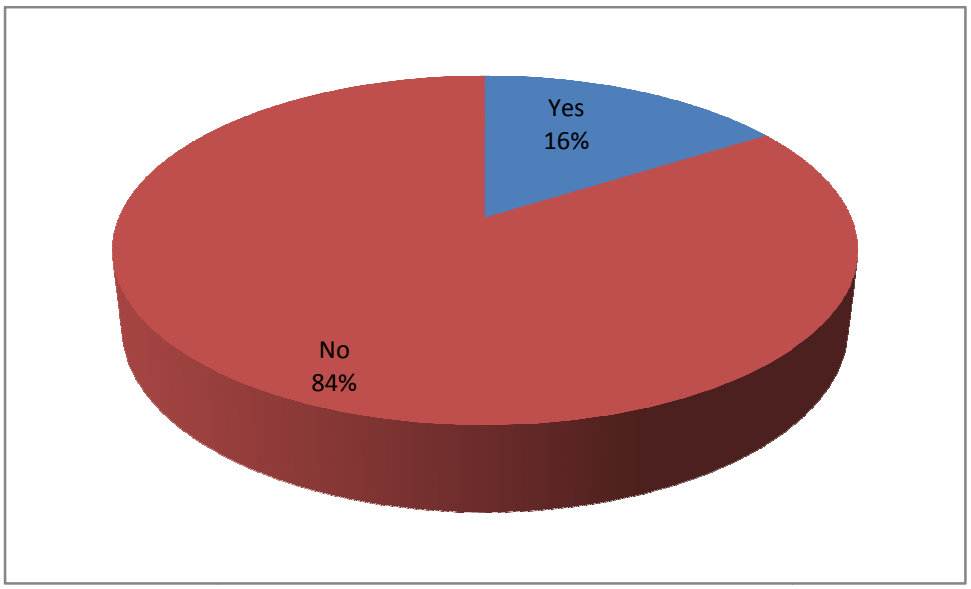


Table 14 shows the frequency of Intra-Operative Zonular Dialysis. 8 (16%) patients had zonular dialysis.

Table 15

PCR

PCR	Frequency	Percent
Absent	42	84
Present	8	16

Figure 15
PCR

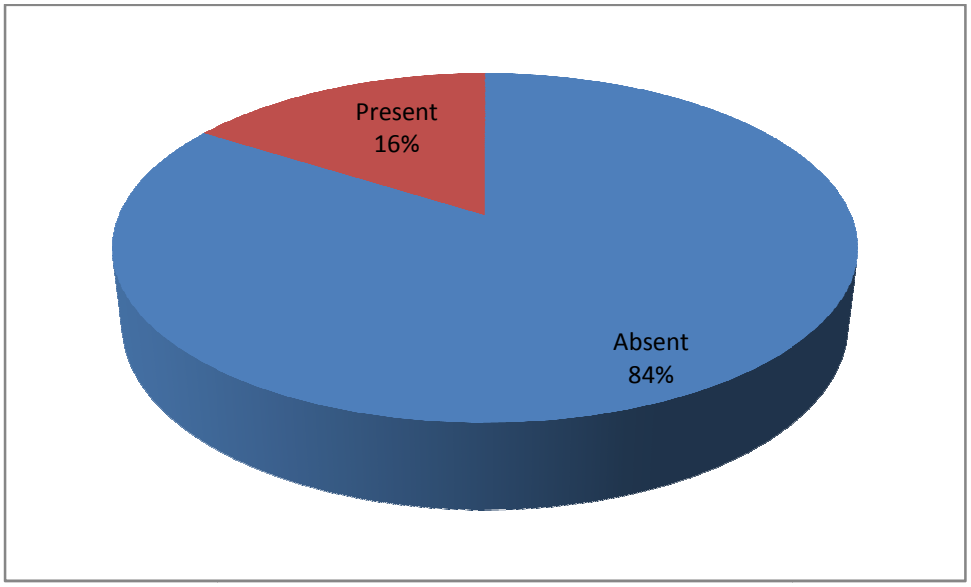


Table 15 shows the frequency of Posterior Capsular Rent. 8(16%) patients had posterior capsular rent.

Table 16

Vitreous loss

Vitreous loss	Frequency	Percent
Absent	42	84
Present	8	16

Figure16

Vitreous loss

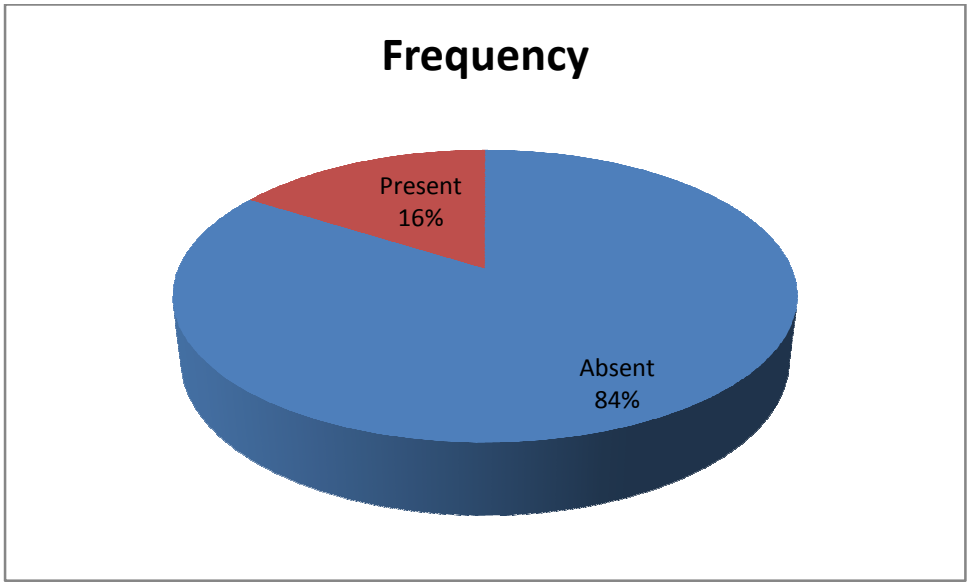


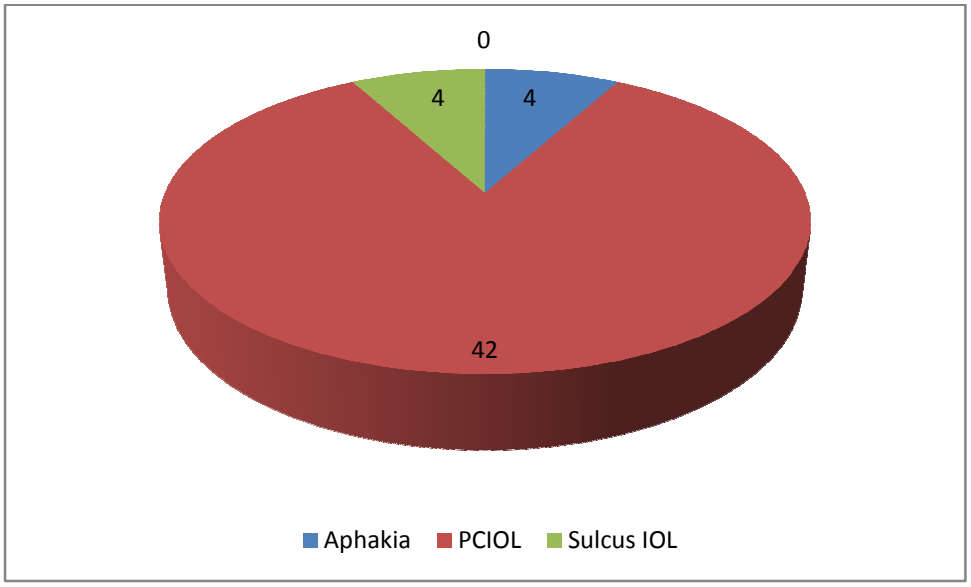
Table 16 shows the frequency of Vitreous loss. 8(16%) patients had Vitreous loss.

Table 17

Type of IOL

	Frequency	Percent
PCIOL	42	84
Sulcus IOL	4	8
Aphakia	4	8

Figure 17
Type of IOL



As shown in table 17, our study shows, 42 (88%) patients were implanted with PCIOL, in 4(8%) patients IOL were implanted on sulcus, other 4(8%) patients were aphakics.

Table 18

Intra Operative Complications

	Frequency	Percent
Absent	27	54
Present	23	46

Figure 18
Intra Operative Complications

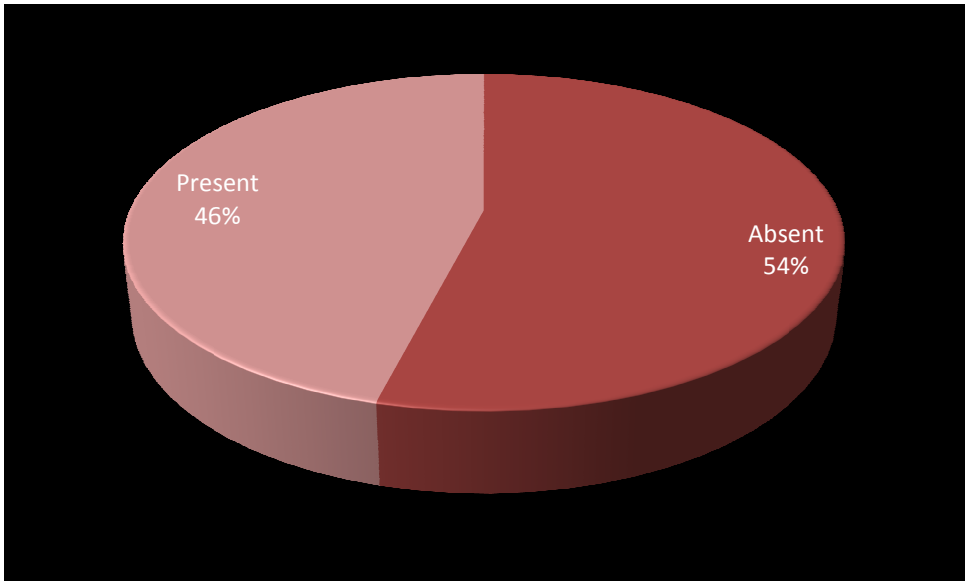


Table 18 shows the frequency of Intra-Operative Complications in PXF patients underwent Cataract Surgery. 23(46%) patients had intra operative complications.

Table 19

Post Operative IOP

	Frequency	Percent
Normal	43	86.0
Raised	7	14.0

Figure 19:

Post Operative IOP

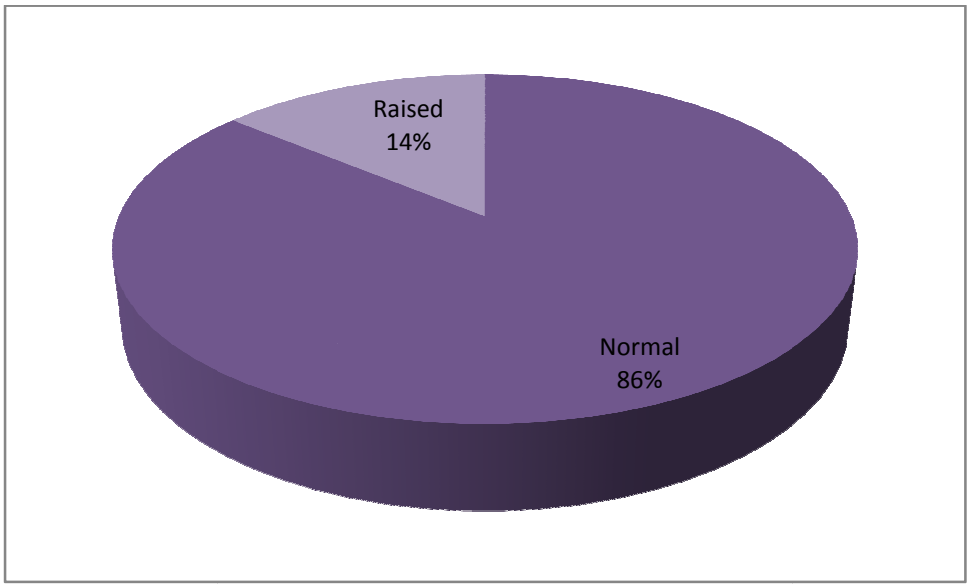


Table 19 shows the frequency of post operative IOP. In 7(14%) patients the IOP was raised. 43(86%) patients had a normal IOP.

Table 20

Post operative inflammation

	Frequency	Percent
Absent	40	80.0
Present	10	20.0

Figure 20

Post operative inflammation

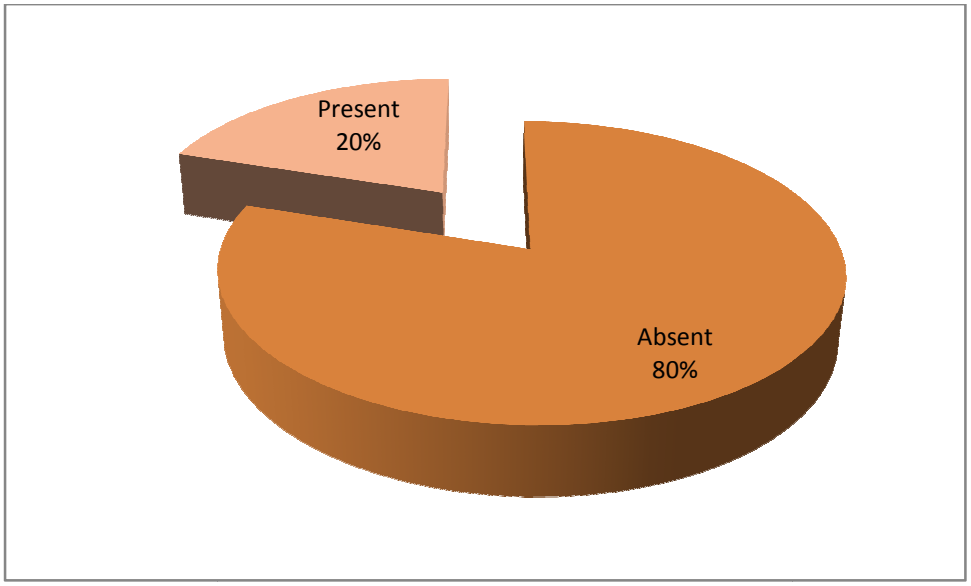


Table 20 shows the Frequency of Post Operative Inflammation in Pseudoexfoliation patients underwent Cataract Surgery.10(20%) patients had post operative inflammation.

Table 21

Post Operative Corneal Oedema

	Frequency	Percent
Absent	42	84.0
Present	8	16.0

Figure 21
Post Operative Corneal Oedema

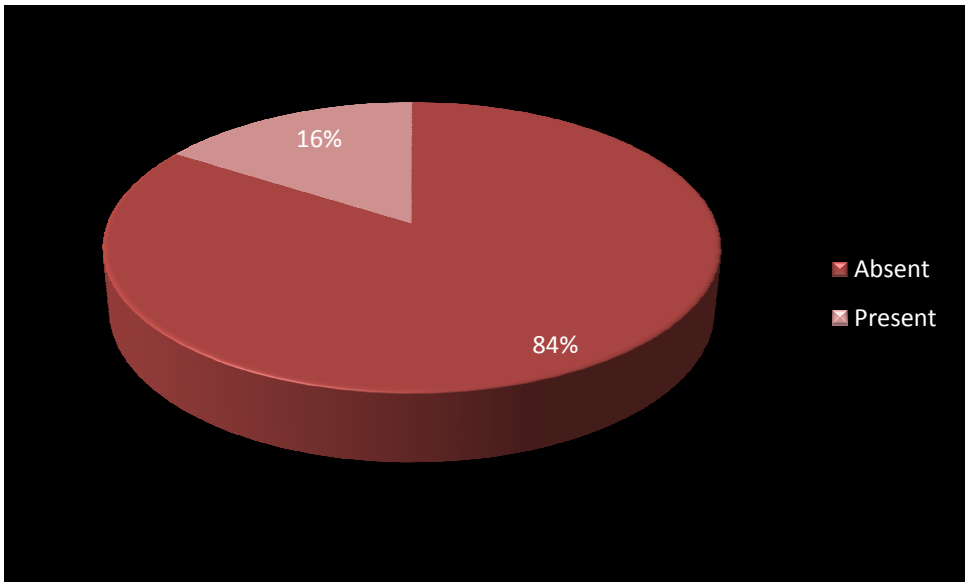


Table 21 shows the frequency of Post Operative Corneal Oedema. 8(16%) patients had post operative corneal Oedema.

Table 22

Post OP V/A

Post OP V/A	Frequency	Percentage
6/18 ~ 6/6	29	58
6/60 ~ 6/24	12	24
< 6/60	9	18

Figure 22

Post OP V/A

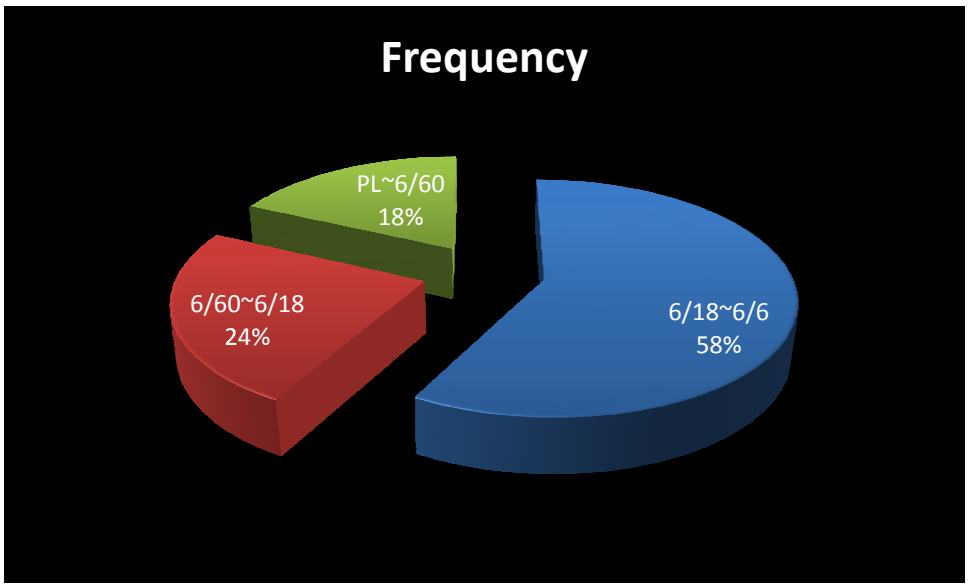


Table 22 shows the frequency of Post operative visual acquity. 29(58%) patients had a good vision (6/6-6/18). 12(24%) patients had an average vision of(6/24-6/60). 9 (18%) patients had <6/60.

Table 23

Pupillary diameter Vs intra operative complications:

Complication	Frequency	Percentage	Mydriasis			
			Sufficient		Insufficient	
			Frequency	Percentage	Frequency	Percentage
DC	11	22	2	18.18	9	81.82
ZD	8	16	0	0	8	100
PCR	8	16	2	25	6	75
VL	8	16	2	25	6	75

Figure 23

Pupillary diameter Vs intra operative complications

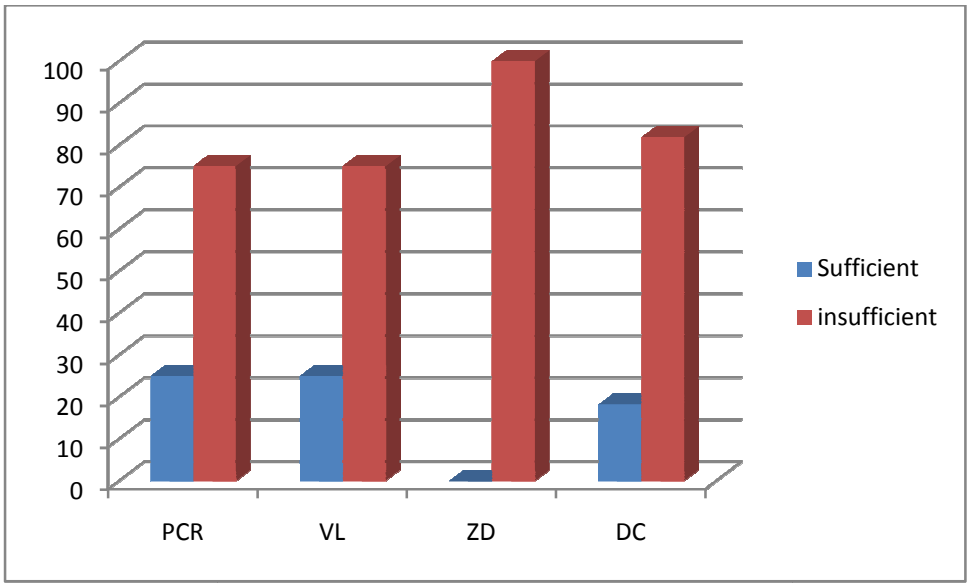


Table 23 shows The Comparison of Pupillary diameter with intra operative Complications.

Table 24

Preop ZD Vs Intra operative complications:

Preop ZD	Intra operative complications		Total
	Absent	Present	
Absent	30	16	46
Present	0	4	4
Total	30	20	50

Figure 24

Preop ZD Vs Intra operative complications

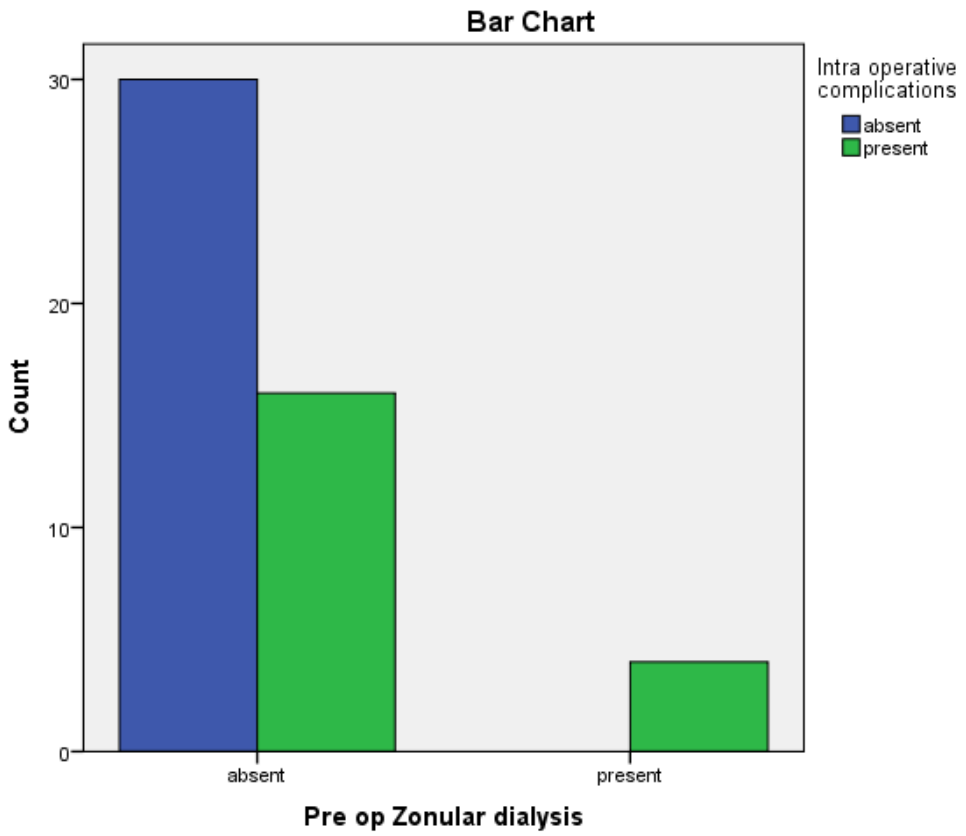


Table 24 shows The Comparison of Pre operative Zonular dialysis with intra operative complications.

Table 25

Pre operative Iridodonesis Vs Intra operative Complications:

Count	Intra operative complications		Total
	Absent	Present	
Absent	30	17	47
Present	0	3	3
Total	30	20	50

Figure 25

Pre operative Iridodonesis Vs Intra operative Complications

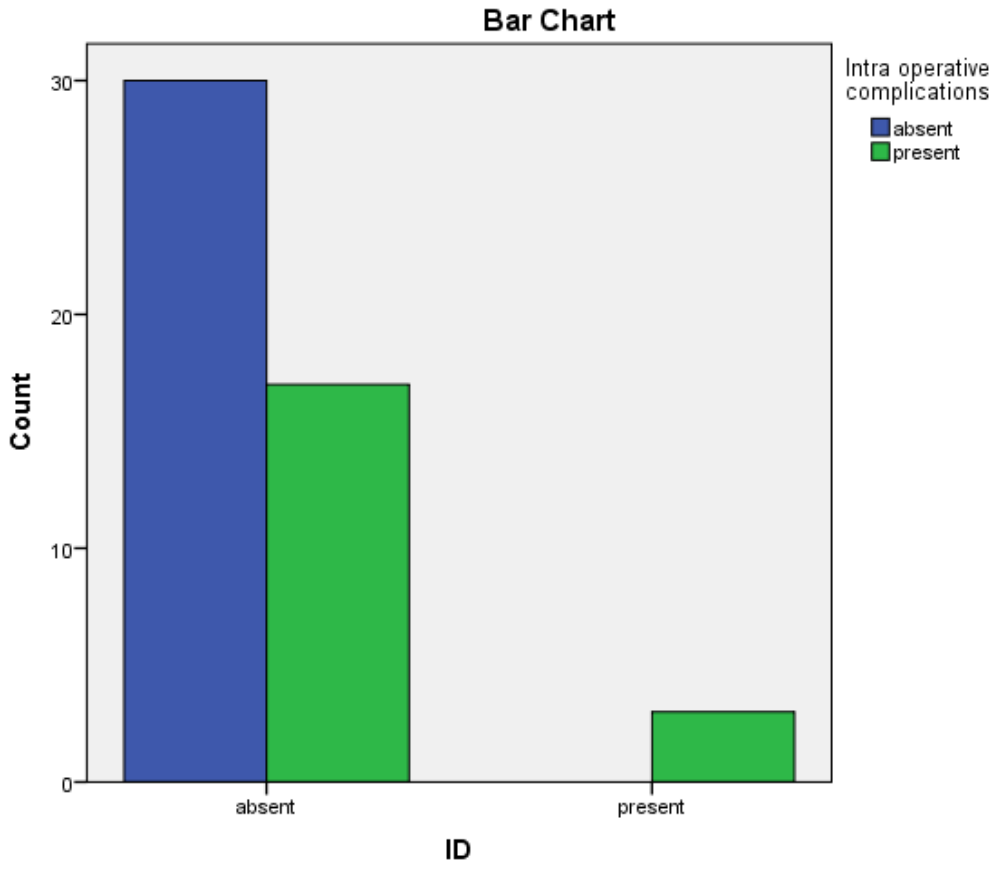


Table 25 shows the comparison of Pre Operative iridodonesis with intra operative complications.

Table 26

Phacodonesis Vs Intra operative complications

Count	Intra operative complications		Total
	Absent	Present	
Absent	30	16	46
Present	0	4	4
Total	30	20	50

Figure 26

Phacodonesis Vs Intra operative complications

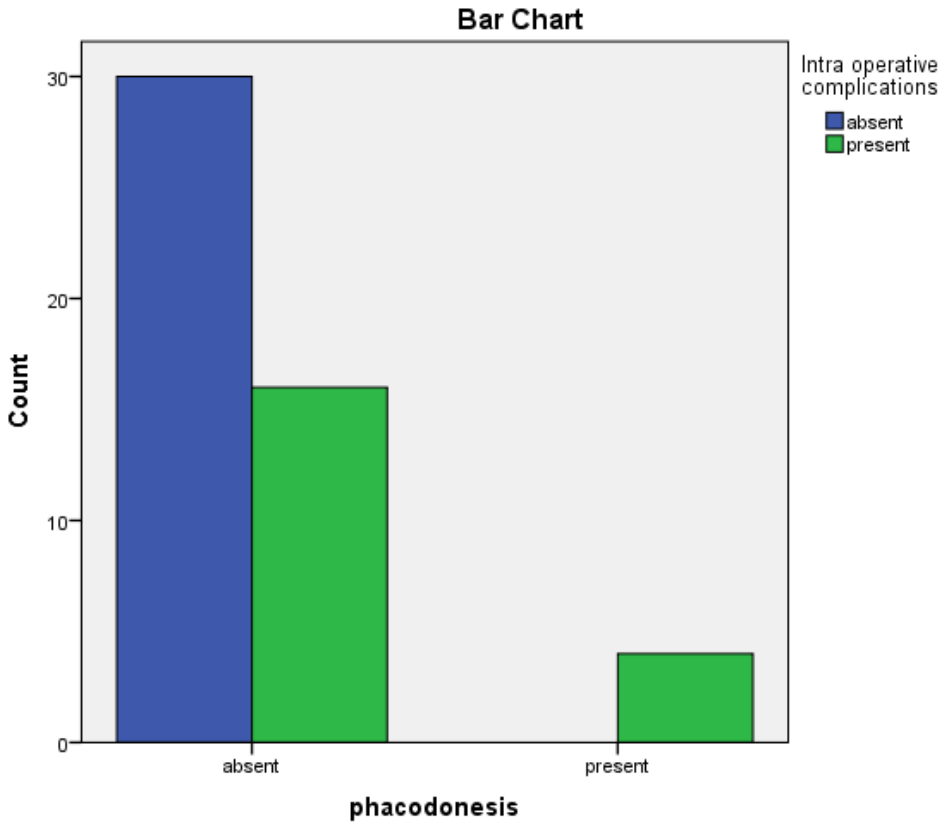


Table 26 shows the comparison of pre operative phacodonesis with intra operative complications.

Table 27

Type of cataract Vs Presence of post op complication:

Type	Presence of post op complication		Total
	Absent	Present	
Cortical cataract	1	0	1
Nucleus sclerosis grade 1	2	0	2
Nucleus sclerosis grade 2	7	2	9
Nucleus sclerosis grade 3	12	4	16
Nucleus sclerosis grade 4	3	8	11
Mature cataract	4	5	9
Hypermature cataract	1	1	2
Total	**30**	**20**	**50**

Figure 27

Type of cataract Vs Presence of post op complication

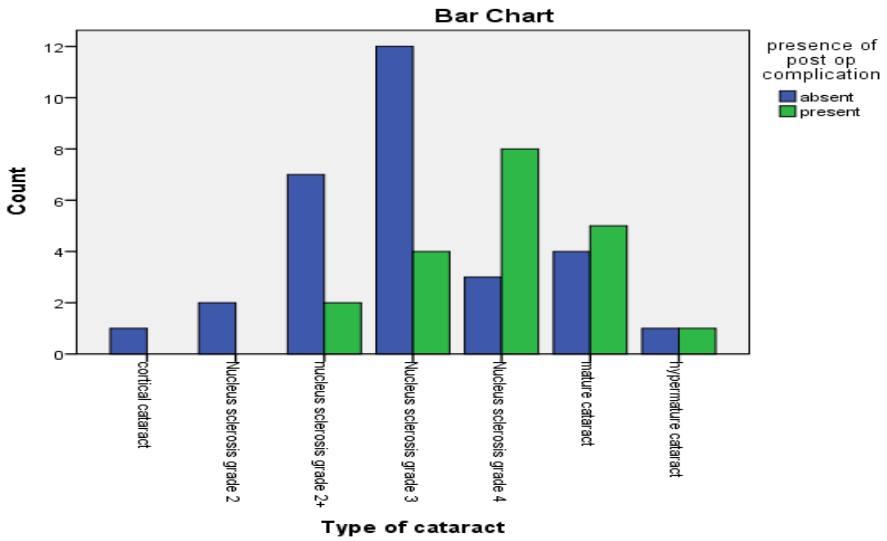


Table 27 shows the comparison of Type of cataract Vs Presence of post op complication.

DISCUSSION

This study comprises of 50 patients with pseudoexfoliation who underwent small incision cataract surgery at department of ophthalmology, Coimbatore medical college hospital, Coimbatore during the period of August 2013 – July 2014.

In this study as shown in table 1, there were 8(16%) patients with PEX belonging to age group of 50-60 yrs, 23(46%) patients with PEX of age group 61-70 yrs, 17(34%) patients of age group 71-80 yrs, 2(4%) patients of age group 81-90 yrs. The mean age of presentation in the study was found to be 69.24 years and majority 42(84%) out of 50 were above 60 years of age.

This finding was consistent with many more studies that showed that the pseudo exfoliation a senile condition and its prevalence increase with ageing.

Table 2 shows, 31(62%) patients with pseudo exfoliation who underwent cataract surgery were males and 19(38%) patients with pseudo exfoliation were females. The male to female ratio was found to be nearly 3:2 with male predominance. Various studies conducted by several authors across the world regarding the sex distribution of pseudo exfoliation were still conflicting. Some series of studies show male

predominance while some other studies show female predominance. This could be possibly explained by the factor that pseudo exfoliation occurs in those who were predominately involved in outdoor activities compared with those engaged in indoor activities.

As shown in table 3, regarding the laterality of pseudo exfoliation 28(56%) were found to have bilateral occurrence and 22(44%) had pseudo exfoliation unilaterally. On reviewing the literature, for the frequency of monocular Vs binocular involvement of pseudo exfoliation, it was found binocular involvement to be more common than monocular involvement.

The ultra structural study conducted by Naumann, Schlotzer-Schrehardt, Hammer (2001) on the contralateral eye of donor eyes with unilateral pseudo exfoliation showed the presence of pseudo exfoliation material in the anterior segment of all the eyes. They concluded that pseudo exfoliation was a bilateral disease with asymmetrical involvement. Even though the reason for asymmetry was unknown, they suggested that unilateral occurrence was a precursor for the bilateral presentation which occurs within 5-10 years.

As shown in table 4, the range of intraocular pressure in the present study was found to be between 11-21 mm of Hg. The mean IOP was

17.09 mmHg on comparing with normal mean IOP (15.5 mmHg), this was found to be quite high. Eyes with pseudo exfoliation were at a cumulative risk for glaucoma, it was found to be 5% and 15% at 5 years and 10 years respectively[7]. This obviates the need for careful follow –up of the patients with pseudo exfoliation. Also, the patients with unilateral pseudo exfoliation glaucoma and only pseudo exfoliation material in the other eye were at high risk (50% chance) of developing glaucoma, on the other hand the absence of pseudo exfoliation in the other eye lowers the risk of glaucoma in that eye[7].

However this study did not include the patients of PXF with raised IOP since the aim was to study purely the intra-operative and postoperative complications caused by pseudo exfoliation and if included it may affect the visual outcome.

Table 5 shows, pseudo exfoliation and its systemic association. It was found that 3 (6%) patients with pseudo exfoliation had an associated diabetes mellitus, 11 (22%) had an associated hypertension, 2 (4%) had an associated Ischaemic heart disease.

The significance of the association could not be assessed since there was no control group in our study. Also majority of the patients of our study were from camps who visited the hospital for the first time. So

there may be a chance of underlying any asymptomatic systemic association that was not detected.

Table 6 shows, the characteristic changes of iris in pseudo exfoliation patients. 47 (94%) had the presence of pseudo exfoliation material along the pupillary margin, 15 (30%) over the surface of iris, 11 (22%) of patients were noted with Iris atrophy, 3 (6%) of patients had iridodonesis and 10 (20%) had the presence of posterior synechiae. The present study is in concurrent with the study made by Ritch Schlotzer. Also in 2001, Scherhardt[88] et al stated that the presence of pseudo exfoliation along the pupillary margin is seen in nearly 84% of patients. More over the presence of pseudo exfoliation material along the iris sphincter is considered to be more consistent and prominent clinical finding next to the lens pseudo exfoliation material.

As shown in table 7, 10 (20%) of patients with pseudo exfoliation had a very poor mydriasis of < 4mm, 25 (50%) of patients with pseudo exfoliation had mydriasis of 5-6mm which is fair and nearly 15 (30%) had a good mydriasis of more than 6mm.

Patients with pseudo exfoliation were more prone for insufficient mydriasis. This was consistent with the other studies made by various authors.

In 1990 Freyler H, Radax U found pupillary dilation less than 4mm in 19 out of 32 pseudo exfoliation patients who underwent cataract surgery[81].

In 1996 Stanila A found quite a lot of patients with pseudo exfoliation with poor pupillary dilation[82].

Asano N, Schlotze-Scherhardt, Naumann (1966) studied the iris characteristics of pseudo exfoliation patients in detail and suggested that the poor mydriasis was found to be due to degenerative change in pupillary muscle fibers including both dilator and sphincter muscle cells account for the insufficient mydriasis[89].

Also in 1966 Repo L.P et al remarked that the poor mydriasis was due to the degenerative changes in both the muscular layer of iris and in stromal tissue[68].

Alfaite et al (1966) observed significant poor mydriasis (P value < 0.001) in their study. They found that the pseudo exfoliation material gets accumulated over the iris surface and results in reduction of stromal elasticity which plays a much significant role in insufficient mydriasis.

Mohammad Jawad et al (2009) noticed 48% with poor pupillary dilation (2-4 mm) 42% with fair pupillary dilation (5-6mm) and 10% with good dilation (7-9mm)[90].

Surekha et al (2012) studied the eyes of pseudo exfoliation patient and found 26% of patients with poor pupillary dilatation

As shown in table 8, out of 50, 1 (2%) patient with pseudo exfoliation had cortical cataract, 11 (22%) patients with early nuclear selerosis including grade I and grade II. 38 (86%) patents had an advanced cataract including nuclear selerosis grade III and IV, mature and hyper mature cataract.

Higher incidence of nuclear cataract and smaller incidence of cortical and supra nuclear opacities were noted by seland JH chylack LT (1982)[10].

Hietanen J et al also reported that nuclear cataract was the predominant type of cataract in their study.

In 2001Ritch R Schlotze-Scherhardt suggested an increased occurrence of nuclear cataract in pseudo exfoliation patients. As noticed by other authors, the present study also had an increased number of advanced cataracts[88].

The present study shows 7(14%) patients of pseudo exfoliation had pigment dispersion.

IN 2004 Kuldar et al noted 34% pigment dispersion on anterior surface of lens and 17.4% on the posterior surface of cornea. The pigment dispersion is due to the release of iris pigment granules from the atrophied pigment epithelium[91].

The released iris pigments may be seen as deposited on the endothelium known as Krukenberg spindle. None of the patients in the present study had this type of distribution of pigments.

In 1986 Prince, A.M, Ritch R proposed that after mydriasis the iris pigments released into the anterior chamber attains a whorl like pattern and gets deposited over the iris sphincter and peripheral iris[53].

In 2000, Ritch R, Schlotzer-Scherhandt noted that patients with pseudo exfoliation had profuse pigment dispersion in anterior chamber after pupillary dilatation. He also added that the presence of pigment granules after pupillary dilatation was one of the suspicious sign to look for pseudo exfoliation syndrome in pre clinical stages.

The present study shows 4(8%) patients of pseudo exfoliation with phacodonesis. In 1989 Futa R. Furnyoshi observed an incidence of 8%.

In 1993 Moreno J., Duch S., Harara J noted an incidence of 10.6% of phacodonesis. This is due to the instability of the weakened zonules.

As shown in table 9, 2 (4%) patients with pseudo exfoliation had subluxation dislocation and 4(8%) had preoperative zonular dialysis.

Poor pupillary dilatation, phacodonesis, subluxation/dislocation of cataractous lens and Zonular dialysis were considered to be the most important risk factors since these factors lead to a rise in intra operative complications.

As shown in table 10, difficulty in anterior capsulotomy was noted in 11(22%) patients. The patients were managed by stretching the pupil manually or by performing a sphincterotomy.

Table 11 shows, in 5(10%) patients with pseudo exfoliation, there was difficulty in nucleus delivery. The most important reason behind this is the presence of large and hard nucleus.

As shown in table 14, 15 and 16, 8(16%) patients with pseudo exfoliation had intra operative zonular dehiscence. 8(16%) patients had posterior capsule rupture and 8(16%) had vitreous loss.

Several studies conducted by various authors also showed the occurrence of zonular dehiscence, Posterior capsule rupture and Vitreous loss intra operatively in patients with pseudo exfoliation to be significant.

In 1989 Schonherrs U et al reported that the chances of intro operative and post operative complications in patients with pseudo exfoliation undergoing cataract surgery were found to be statistically significant.

In 1998 Scrolloli et al reported that patients with pseudo exfoliation were five times at high risk for development of intraoperative complications during cataract surgery compared to normal cataract.

In 1990 Freyler H, Radar U reported in his study that out of 36 patents 26 with pseudo exfoliation syndrome had intra operative complications like Zonular dehiscence, posterior capsular rupture and Vitreous loss which further lead on to post operative complications like de-centeration of IOL, corneal edema and inflammation[81].

Other studies which offers a significant intra-operative complications in patients with pseudo exfoliation includes

a) Holding G (1998) reported the incidence of zonular dehiscence as 18%

b) Avramides S (1997) reported it as 13%

c) Lumme P, Laatikanan (1993) reported it as 15%

Regarding posterior capsular rent and vitreous loss, Stanila (1996) noted that there was an increased incidence of posterior capsular rent and vitreous loss in their study.

In 2000 Kuchle et al noted 6.9% of incidence of intra-operative complications such as zonular dehiscence and vitreous loss[80].

In 2001 Ritch R reported that the presence of zonular fragility increases the intra-operative complications like Dislocation of lens, Zonular dehiscence and Vitreous loss to tenfold[88].

In 1993 Lumme P, Laatikanen L noted that Vitreous loss was fourfold more in pseudo exfoliation eyes and the chance of posterior capsular rupture was tenfold higher in pseudo exfoliation patients underwent cataract surgery[77].

Similarly, in 1997 Avramides S, Travamidies P, Sakkias G in their study of 84 patients with pseudo exfoliation undergoing cataract surgery found the occurrence of posterior capsular rupture was 10.4% and Vitreous loss was 7.14%.

Also Junemann, Martus. P et al noted an incidence of 6.7% vitreous loss in eyes with pseudo exfoliation syndrome undergoing cataract sugery.

In 1978 Naumann G.O., Kuchle M., Schonher U reported a seven fold increase of vitreous loss and 4.2% incidence of posterior capsular rupture in eyes with pseudo exfoliation undergoing cataract surgery.

As shown in table 23 on comparing the pupillary diameter with intra-operative complications. Out of 8 patients with posterior capsular rupture 6 (75%) had insufficient mydriasis compared to 2 (25%) who had sufficient pupillary dilatation. Regarding vitreous loss out of 8 patients, 6 (75%) had insufficient mydriasis whereas 2 (25%) had adequate pupillary dilatation. Out of 8 patients who had zonular dialysis, all these patients had an insufficient mydriasis.

On comparing the size of pupillary diameter with intra-operative complications a significant correlation (P = 0.021) was obtained.

Also there was a significant correlation between the size of pupillary diameter and post operative complications (P = 0.016).

The present study correlates well with the other studies conducted by Freyler H., Radax U (1990), Stanilla A (1996), Repo L.P. et al (1996), Asano N. et al (1996) and Avramides S et al (1997).

In 2002, Vickie Lee and Anthony Maloof did an exclusive study on small pupils and their management in cataract surgery. They suggested

that the poorly dilated pupils can be managed by prosthetic and non-prosthetic methods[83].

Since the prosthetic methods are unavailable in our setup, most of the cases with poor pupillary dilatation are managed either by sphincterotomy, visco-mydriasis, and by manual iris stretching.

As shown in table 17, 42 (84%) patients were implanted with posterior chamber intraocular lens, 4 (8%) patients were implanted with IOL on sulcus. 4 (8%) patients were left aphakic since there was no adequate capsular support. These cases can be managed secondarily with sclera fixated intraocular lens after doing an anterior vitrectomy.

In the present study, as shown in table 19, 7 (14%) patients with pseudo exfoliation who underwent cataract surgery had a rise in intraocular pressure post-operatively. Similar result of postoperative increase in IOP was found in 15.6% in a study conducted by Abid Naseem et al.

In 1989 Krupin T, Feiti ME, Bishop K studied the postoperative intraocular pressure changes in PEX patients who underwent cataract surgery. He reported that the patients with pseudo exfoliation are at high chance of raised intra ocular pressure in the immediate post operative

period. So, he suggested all viscoelastic substances should be removed thoroughly during the time of surgery.

He also added that the PEX patients with field loss and advanced glaucomatous changes should be monitored 4th hourly for IOP and it should be effectively managed.

As shown in table 20, the present study shows postoperative inflammation in 10 (20%) patients. The chances of getting a fibrinoid reaction in the post operative period was due to breakage of blood-aqueous barrier which can happen preoperatively or intra-operatively due to improper handling in an inadequately dilated pupil. Also it can be due to the retained lens material.

As shown in table 21, in our study 8 (16%) patients with pseudo exfoliation who underwent cataract surgery had corneal edema postoperatively.

Abid Naseem et al showed in their study the incidence of post operative corneal edema was 43.8%. Yet another study done by K.Pranathi et al showed 11.5% of post operative corneal edema.

As shown in table 21, the present study shows a visual acuity of 6/6 – 6/18 in 29 (58%) patients with pseudo exfoliation who underwent

cataract surgery. 12 (24%) patients had 6/60 – 6/18 vision. Remaining 9 (18%) patients had poor visual acuity of less than 6/60.

Our study shows 5 (10%) of patients with dislocation of IOL in the immediate post operative period. 6 (12%) of patients showed iris pigment dispersion over IOL.

Limitations of our study were a control group was not available for comparison. Even though, follow-up period was planned for 45 days, since most of our patients were from remote areas, they could not be followed up for post operative complications. Hence, the immediate postoperative complications alone were included in the study.

Also it was a small-scale cross sectional descriptive study and it requires a large scale study to test the findings in huge population.

SUMMARY

The study titled "**Perioperative Complications in patients with Pseudoexfoliation undergoing small incision cataract surgery**" done at Department of Ophthalmology, Coimbatore Medical College Hospital, Coimbatore during the period of August 2013-July 2014 includes 50 patients.

The mean age of presentation in the study was found to be 69.24 years and majority 42(84%) out of 50 were above 60 years of age. The male to female ratio was found to be nearly 3:2 with male predominance. It was found binocular involvement to be more common than monocular involvement. The mean IOP was 17.09 mmHg, on comparing with normal mean IOP (15.5 mmHg), this was found to be quite high.

The significance of the systemic association could not be assessed since there was no control group in our study. Patients with pseudo exfoliation were more prone for insufficient mydriasis. This was consistent with the other studies made by various authors. 38 (86%) patents had an advanced cataract including nuclear sclerosis grade III and IV, mature and hyper mature cataract. On comparing the size of pupillary diameter with intra-operative complications a significant correlation (P = 0.021) was obtained.

Also, the present study showed that the poor mydriasis, Pre operative Zonular dialysis, Iridodonesis, Phacodonesis and type of cataract were the most common risk factors that affect the surgical outcome.

CONCLUSION

The following conclusions were drawn from the study

Patients with Pseudoexfoliation syndrome and cataract posted for small incision cataract surgery, have to be carefully looked for Zonular weakness, insufficient mydriasis, Phacodonesis, Subluxation/Dislocation of cataractous lens because these preoperative risk factors can alter the surgical outcome.

Inadequate mydriasis, one of the major pre operative risk factor in eyes with Pseudoexfoliation syndrome which has a bearing on the intra operative complications like posterior capsular rent and vitreous loss. Adequate surgical modifications such as Sphincterotomy, Synechiolysis and manual stretching of pupil increase the pupil size and reduce the intra operative complications.

All though Cataract surgery in Pseudoexfoliation is challenging, if the surgeon is aware of the condition pre operatively and pays meticulous attention to the surgical technique during small incision cataract surgery, the intraoperative complications can be managed and good outcome can be expected.

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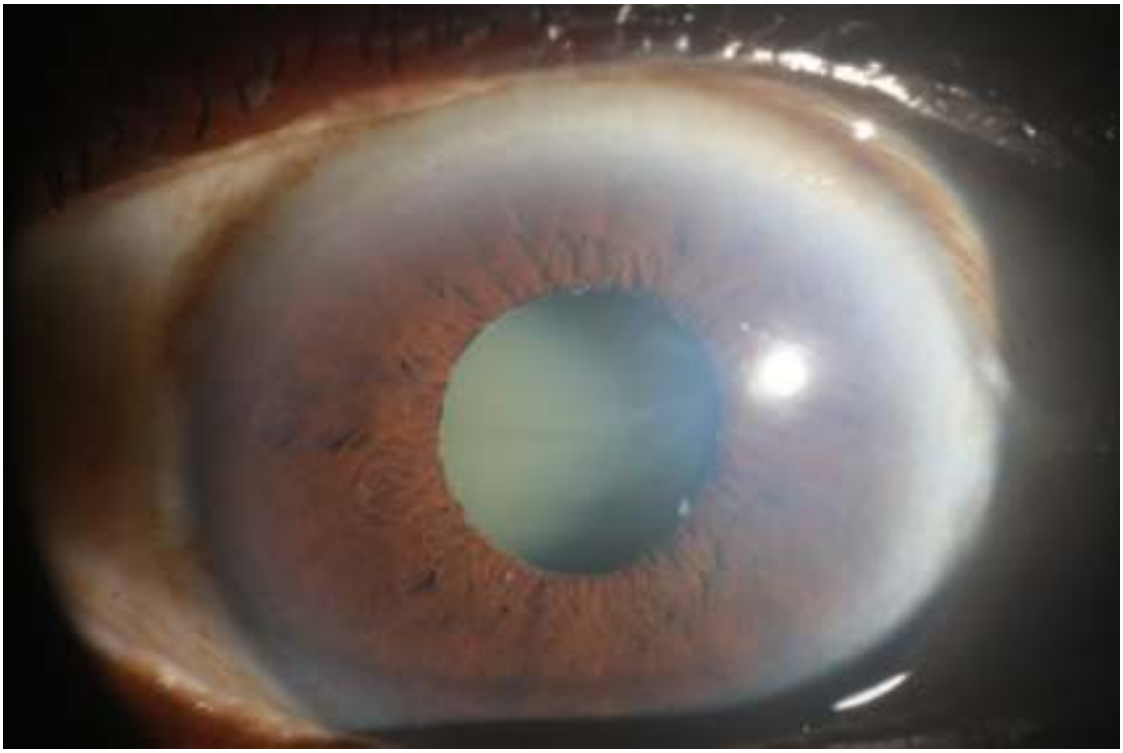
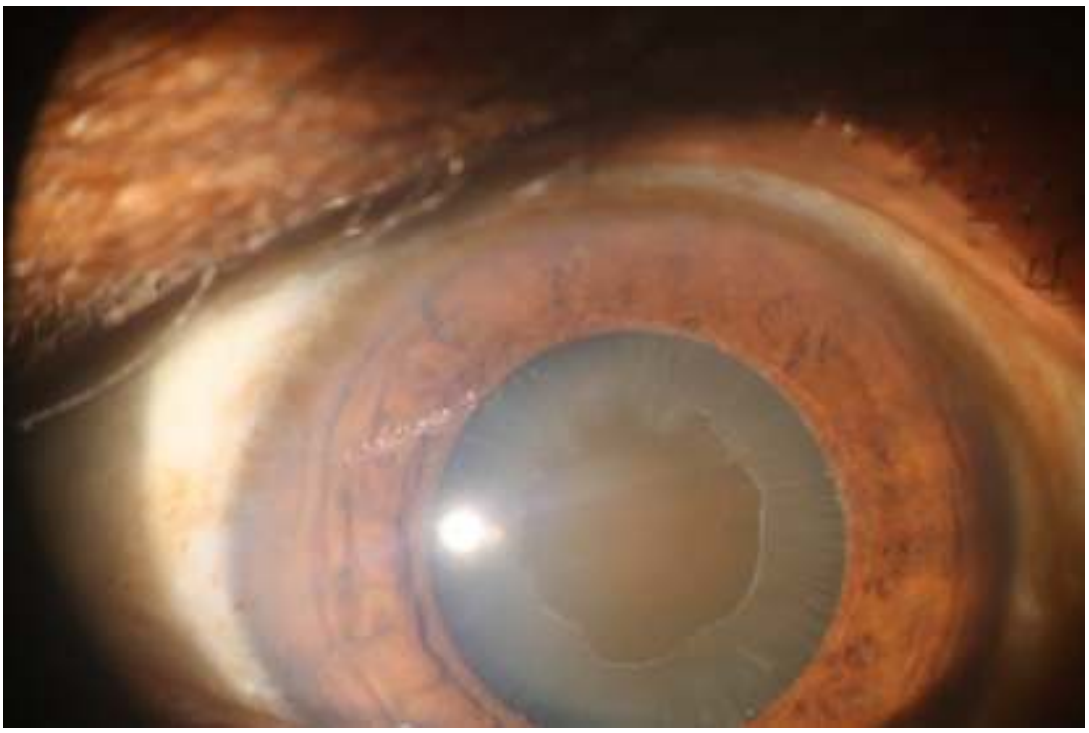
COLOUR PLATES

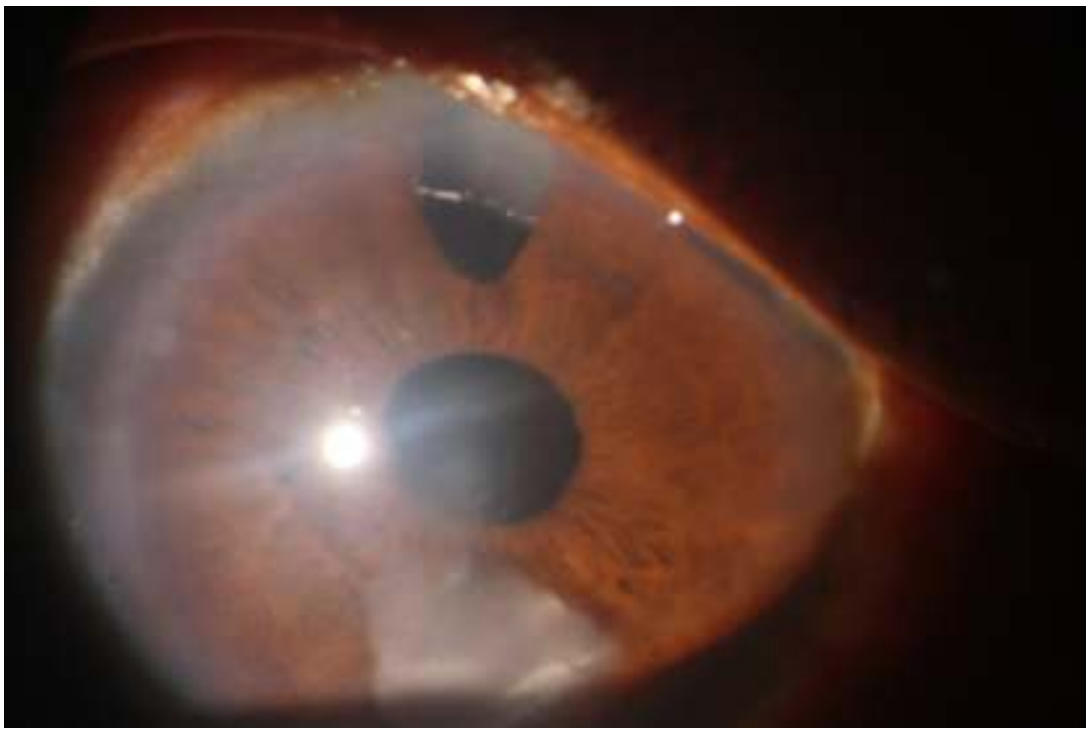
PSEDUOEXFOLIATION MATERIAL AT THE PUPILLARY MARGIN



ZONES OF PSEUDOEXFOLIATION MATERIAL ON THE ANTERIOR CAPSULE OF LENS AFTER DILATATION



POST OPERATIVE PICTURE SHOWING PERIPHERAL IRIDECTOMY WITH RETAINED CORTICAL MATERIAL



PROFORMA

NAME:

AGE:

SEX:

IP NO:

OCCUPATION:

HISTORY OF PRESENT ILLNESS:

PAST HISTORY: DM/ HT/IHD/ASTHMA

EXAMINATION: **RE** **LE**

VISUAL ACUITY

distant

near

pinhole

1. EYE LIDS
2. CONJUNCTIVA
3. CORNEA

4. ANTERIOR CHAMBER

5. IRIS

Pattern

PEX on pupillary margin

PEX on surface

Atrophy

Iridodonesis

6. PUPIL

Size (pre dilation)

Size(post dilation)

7. LENS

Type

Phacodonesis

Subluxation/dislocation

Zonular dialysis

8. EXTRA OCULAR MOVEMENTS

9. GONIOSCOPY

10. FUNDUS

INVESTIGATIONS:

1. IOP
2. DUCT PATENCY
3. RANDOM BLOOD GLUCOSE
4. BLOOD PRESSURE
5. URINE SUGAR

COMPLICATIONS OBSERVED

1. NON-DILATING PUPIL

Stretching of pupil

Sphincterotomy

2. DIFFICULTY DURING CAPSULOTOMY
3. DIFFICULTY IN NUCLEUS DELIVERY
4. PC RENT
5. VITREOUS LOSS

6. ZONULAR DIALYSIS
7. CORNEOENDOTHELIAL TOUCH
8. OTHER COMPLICATIONS
9. SURGICAL OUTCOME

1ST POST OP DAY:

1. TEST VISION
2. IOP
3. SLIT LAMP EXAMINATION

Corneal edema

Inflammation

Dislocation of IOL

Pigment dispersion

NEXT VISIT

1. TEST VISION
2. IOP
3. SLIT LAMP EXAMINATION

CONSENT FORM

Here by I volunteer and to participate in this study **"PERIOPERATIVE COMPLICATIONS IN PATIENTS WITH PSEUDOEXFOLIATION UNDERGOING SMALL INCISION CATARACT SURGERY".** I was fully explained about the nature of this study by the doctor, knowing which I Mr/Mrs_____ fully consent to volunteer in this study.

Date:

Place: Signature of the volunteer

Signature of Witness

ஒப்புதல் படிவம்

பெயர் :

பாலினம் : வயது :

முகவரி :

அரசு கோவை மருத்துவக் கல்லூரியில் கண் மருத்துவ துறையில் பட்ட மேற்படிப்பு பயிலும் மாணவி அவர்கள் மேற்கொள்ளும் "**சூடோஎக்ஸ் ஃபோலியேஷன் உடைய நோயாளிகளுக்கு கண்புரை அறுவை சிகிச்சை செய்யும் போதும், பிறகும் ஏற்படும் விளைவுகள்** " குறித்த ஆய்வில் செய்முறை மற்றும் அனைத்து விவரங்களையும் கேட்டுக் கொண்டு எனது சந்தேகங்களை தெளிவுப்படுத்திக் கொண்டேன் என்பதை தெரிவித்துக் கொள்கிறேன்.

நான் இந்த ஆய்வில் முழு சம்மதத்துடன், சுய சிந்தனையுடனும் கலந்து கொள்ள சம்மதிக்கிறேன்.

இந்த ஆய்வில் என்னுடைய அனைத்து விபரங்கள் பாதுகாக்கப்படுவதுடன் இதன் முடிவுகள் ஆய்விதழில் வெளியிடப்படுவதில் ஆட்சேபனை இல்லை என்பதை தெரிவித்துக் கொள்கிறேன். எந்த நேரத்தில் இந்த ஆய்விலிருந்து நான் விலகிக் கொள்ள எனக்கு உரிமை உண்டு என்பதையும் அறிவேன்.

இடம் : கையொப்பம் / ரேகை

நாள் :

KEY TO MASTER CHART

IP No	–	Inpatient number
UL/BL	–	Unilateral/Bilateral
N	–	Normal
N+	-	Normal surface with presence of PXF material on surface
PM	–	PXF on pupillary margin
PS	–	Posterior synechiae
RTL	–	Reacting to Light
SRTL	–	Sluggishly reacting to light
PID	–	Pigment dispersion
NS	–	Nuclear sclerosis
PSC	–	Posterior subcapsular cataract
MC	–	Mature cataract
HMC	–	hyper mature cataract
Pz	–	PXF material on peripheral zone of anterior capsule
Cz	-	PXF material on central zone of anterior capsule
PD	–	Phacodonesis
SL/DL	–	Subluxation/Dislocation
ZD	–	Zonular dialysis
IOP	–	Intraocular Pressure
DM	–	Diabetic mellitus

HT	–	Hypertension
IHD	–	Ischaemic heart disease
ID	–	Iridodonesis
CC	–	Cortical cataract
PxM	–	PXF material present in trabecular meshwork
PxS	–	PXF material present in schwalbes line
SICS	–	Small incision cataract surgery
PCIOL	–	Posterior chamber intraocular lens
IOLIS	-	Intraocular lens in sulcus
Sph	–	Sphinterotomy
DC	–	Difficulty during anterior capsulotomy
DN	–	Difficulty during nucleus delivery
CET	–	Corneal endothelial touch
PCR	–	Posterior capsular rent
VL	–	Vitreous loss
UCVA	–	Uncorrected visual acquity
I	–	Increased
IFN	–	Inflammation
CE	–	Corneal Edema
DI	–	Dislocation of IOL
IPD	–	Iris Pigment dispersion
CFCF	–	Counting fingers close to face

Sl.No	Name	IP No	Age	Sex	UL/BL	POV	IOP	Systemic Disease				Iris					Pupil				Lens				Gonioscopy			Surgery															Post-OP					
																	Pre-Dilatation		Post-Dilatation						Angle		PxM	PxS	Technique	Outcome		Sph	Complications									Complications					
								DM	HT	IHD	Others	Pattern	PM	PS	Atrophy	I/D	Size	Reaction	Size	PID	Type of Cataract	PXF	PD	SL/DL	ZD						DC	PD	ZD	DN	CET	PCR	VL	UCVA	IOP	IFN	CE	DI	PS	IPD
1	shanmugam	42569	53	M	UL	3/60	17.3	0	0	0	0	N	1	0	0	0	3	RTL	5	0	NS II	1	0	0	0	OPEN	1	0	SICS	PCIOL	0	0	0	0	0	0	0	0	6/12	N	0	0	0	0	0
2	Natesan	42671	62	M	BL	3/60	20.6	0	0	0	0	N1	1	1	1	0	3	RTL	5	1	NSIV	1	0	0	0	OPEN	1	1	SICS	PCIOL	0	0	0	0	0	0	0	0	6/36	I	1	0	0	0	0
3	Rangasamy	44317	70	M	UL	5/60	17.3	0	0	0	0	N	1	0	0	0	3	RTL	6	0	NSIV	1	0	0	0	OPEN	1	0	SICS	PCIOL	0	0	0	0	0	0	0	0	6/9	N	0	0	0	0	0
4	kuppayammal	44567	75	F	BL	PL1	20.6	0	0	0	0	N1	1	0	1	1	3	SRTL	5	0	MC	1	1	0	1	OPEN	1	1	SICS	PCIOL	1	1	1	1	1	1	0	0	1/60	I	1	1	1	1	0
5	kannimuthu	44764	63	M	BL	6/60	14.6	0	0	0	0	N1	1	0	0	0	3	RTL	4	0	NSIII1PSC	1	0	0	0	OPEN	1	0	SICS	IOLIS	1	0	0	0	0	0	1	1	2/60	I	1	1	0	0	0
6	Lakshmi	32157	73	F	BL	3/60	17.3	0	0	0	0	N	1	0	0	0	3	RTL	5	0	NSIV	1	0	0	0	OPEN	1	0	SICS	PCIOL	0	0	0	0	0	0	0	0	6/12	N	0	0	0	0	1
7	Valliathal	32254	70	F	BL	1/60	20.6	0	1	0	0	N	1	0	0	0	2	RTL	4	0	NSIII1PSC	1	0	0	0	OPEN	1	0	SICS	PCIOL	1	1	0	0	0	0	0	0	6/24	N	0	0	0	0	0
8	Palanathal	56734	70	F	BL	5/60	13.3	0	1	0	0	N	0	0	0	0	3	RTL	6	0	NSIII	1	0	0	0	OPEN	1	0	SICS	PCIOL	0	0	0	0	0	0	0	0	6/18	N	0	0	0	0	0
9	Chinnapan	57908	68	M	UL	4/60	17.3	0	1	0	0	N	0	1	0	0	2	RTL	4	0	NSII1PSC	1	0	0	0	OPEN	0	0	SICS	PCIOL	1	1	0	0	0	0	0	0	6/18	N	0	0	0	0	0
10	Singaravelu	47869	75	M	BL	CFCF	19.3	0	0	0	0	N1	1	1	1	0	3	RTL	5	0	NSIV	1	0	0	0	OPEN	1	0	SICS	PCIOL	0	0	1	1	0	0	0	0	6/24	N	0	1	0	0	0
11	Karuppan	67528	73	M	BL	3/60	20.6	0	1	0	0	N	1	0	0	0	3	RTL	6	0	NSIV	1	0	0	0	OPEN	1	0	SICS	PCIOL	0	0	0	0	0	0	0	0	5/60	I	0	0	0	0	1
12	Ramasamy	68489	60	M	UL	4/60	17.3	0	0	0	0	N	1	1	0	0	3	RTL	5	0	NSIII	1	0	0	0	OPEN	0	0	SICS	APHAKIA	1	0	0	0	0	0	1	1	1/60	N	0	1	0	0	0
13	Karuppayammal	70349	80	F	BL	1/60	17.3	0	0	0	0	N1	1	1	1	0	3	RTL	7	1	MC	1	0	0	0	OPEN	0	0	SICS	PCIOL	0	0	0	0	0	0	0	0	6/36	N	0	0	0	0	0
14	Palani	71993	85	M	UL	PL1	17.3	0	0	0	0	N	1	1	1	0	3	RTL	6	1	MC	0	1	0	1	OPEN	1	0	SICS	IOLIS	0	0	0	1	0	0	1	1	6/24	N	1	0	0	0	0
15	Mariyammal	73986	62	F	BL	CFCF	13.3	0	1	0	0	N	1	1	0	0	2	RTL	4	0	MC	1	0	0	0	OPEN	1	0	SICS	PCIOL	1	0	0	0	0	0	0	0	6/9	N	0	0	0	0	0
16	Cinnamani	75682	68	F	UL	1/60	17.3	0	1	0	0	N	1	1	0	0	3	RTL	4	1	NSII1PSC	0	0	0	0	OPEN	1	1	SICS	PCIOL	1	0	0	0	0	0	0	0	6/9	N	0	0	0	0	0
17	Angammal	76895	68	F	UL	6/36	14.6	0	0	0	0	N	1	1	0	0	2	RTL	4	0	NSIII	1	0	0	0	OPEN	0	0	SICS	PCIOL	1	0	0	0	0	0	0	0	6/18	N	0	0	0	0	0
18	Kaliyammal	77654	73	F	UL	1/60	19.3	0	0	1	0	N	1	0	0	0	3	SRTL	5	0	NSIII	1	0	0	0	OPEN	0	0	SICS	PCIOL	0	0	0	0	0	0	0	0	3/60	N	0	0	0	0	0
19	pappathi	79567	75	F	UL	HM	20.6	0	0	0	0	N	1	0	1	1	3	SRTL	6	1	MC	1	1	0	1	OPEN	1	1	SICS	PCIOL	0	0	1	1	0	0	0	0	CFCF	N	1	0	1	0	0
20	paranjothi	86754	68	M	BL	2/60	17.3	0	0	1	0	N	1	1	0	0	3	RTL	8	0	NSII1PSC	1	0	0	0	OPEN	1	1	SICS	PCIOL	0	1	0	0	1	1	0	0	6/12	N	0	0	0	0	0
21	palanivel	89704	65	M	UL	5/60	17.3	0	0	0	0	N	1	0	0	0	3	RTL	8	0	NSIII	1	0	0	0	OPEN	1	1	SICS	PCIOL	0	0	0	0	0	0	0	0	6/18	N	0	0	0	0	0
22	Veerasamy	89935	67	M	UL	3/60	13.3	0	0	0	0	N	1	0	0	0	3	RTL	5	0	NSIII	1	0	0	0	OPEN	1	0	SICS	PCIOL	0	1	0	0	0	0	0	0	6/9	N	0	0	0	0	0
23	Chellamuthu	91023	65	M	UL	5/60	17.3	0	0	0	0	N	1	0	0	0	3	RTL	8	0	NSIII	1	0	0	0	OPEN	0	0	SICS	PCIOL	0	1	0	0	1	0	0	0	6/9	N	0	0	0	0	0
24	Ramalan bevi	92567	75	F	BL	PL1	18.9	0	1	0	0	N	1	0	0	0	3	RTL	5	0	HMC	1	0	0	0	OPEN	1	0	SICS	PCIOL	1	0	0	0	0	0	0	0	6/24	N	1	0	0	0	0
25	Kuppusamy	96743	70	M	BL	3/60	13.3	0	0	0	0	N1	1	0	1	0	3	RTL	7	0	NSIV	1	0	0	0	OPEN	0	0	SICS	PCIOL	0	0	0	0	0	0	0	0	6/18	N	0	0	0	0	0
26	Muppathal	98211	65	F	BL	5/60	17.3	0	0	0	0	N	1	0	0	0	2	RTL	4	0	NSII1PSC	1	0	0	0	OPEN	0	0	SICS	PCIOL	1	1	0	0	1	0	0	0	6/60	I	1	0	0	0	0
27	Kupammal	98371	68	F	BL	5/60	17.3	0	0	0	0	N	1	0	0	0	3	RTL	8	0	NSIII	1	0	0	0	OPEN	0	0	SICS	APHAKIA	0	0	0	0	0	0	1	1	1/60	I	I	0	0	0	0
28	Mustafa	98450	62	M	UL	2/60	18.9	0	0	0	0	N	1	0	0	0	3	RTL	8	0	NSIII	1	0	0	0	OPEN	1	0	SICS	PCIOL	0	0	0	0	0	0	0	0	6/12	N	_	0	0	1	1
29	Pitchai	98500	60	M	UL	4/60	13.3	0	0	0	0	N	1	0	0	0	3	RTL	8	0	NSII1PSC	1	0	0	0	OPEN	0	0	SICS	PCIOL	0	0	0	0	0	0	0	0	6/9	N	0	0	0	0	0
30	Karuppasamy	99321	65	M	BL	4/60	17.3	0	0	0	0	N1	1	1	1	0	3	RTL	5	1	NSIII	1	0	0	0	OPEN	0	0	SICS	PCIOL	0	0	0	1	0	0	0	0	6/36	N	0	0	1	0	0
31	Patchaimuthu	10018	58	M	UL	3/60	14.6	1	0	0	0	N	1	0	0	0	3	RTL	8	0	NSII1PSC	1	0	0	0	OPEN	0	0	SICS	PCIOL	0	0	0	0	0	0	0	0	6/12	N	0	0	0	0	0

32	Arunachalam	10287	63	M	BL	6/60	14.6	0	0	0	0	N	1	0	0	0	3	RTL	5	0	NSII1PSC	1	0	0	0	OPEN	1	0	SICS	PCIOL	1	1	0	0	0	0	0	0	6/18	I	0	0	1	0	0
33	Palaniammal	11765	65	F	UL	5/60	12.2	0	0	0	0	N1	1	0	0	0	3	SRTL	5	0	NSIII	1	0	0	0	OPEN	1	1	SICS	PCIOL	0	0	0	0	0	0	0	0	6/9	N	0	0	0	0	0
34	Muthupetchi	12034	55	F	BL	5/60	17.3	0	0	0	0	N	1	0	0	0	2	RTL	8	0	CC	1	0	0	0	OPEN	1	0	SICS	IOLIS	0	0	0	0	0	0	1	1	6/18	N	0	0	0	0	0
35	Vellaiyan	12987	87	M	BL	PL1	20.6	0	0	0	0	N	1	0	1	1	3	SRTL	5	1	HMC	1	1	0	1	OPEN	1	0	SICS	PCIOL	1	0	1	1	0	0	0	0	6/18	N	0	0	0	0	0
36	Muthuvel	13623	78	M	BL	2/60	20.6	0	1	0	0	N	1	0	1	0	3	RTL	7	0	NSII1PSC	1	0	0	0	OPEN	0	0	SICS	PCIOL	0	0	0	0	0	0	0	0	6/36	N	0	0	0	0	0
37	Kalisamy	13976	65	M	UL	1/60	17.3	0	0	0	0	N1	1	0	0	0	3	RTL	6	0	NSIII	1	0	0	0	OPEN	0	0	SICS	PCIOL	0	0	0	0	0	0	0	0	6/6	N	0	0	0	0	0
38	Parvathy	28796	58	F	BL	3/60	17.3	0	0	0	0	N	1	0	0	0	3	RTL	8	0	NSIII	0	0	0	0	OPEN	1	1	SICS	PCIOL	0	0	0	0	0	0	0	0	6/18	N	0	0	0	0	0
39	Kumarasamy	30562	53	M	UL	6/60	14.6	1	0	0	0	N	1	0	0	0	3	RTL	5	0	NSII	1	0	0	0	OPEN	0	0	SICS	PCIOL	1	0	0	0	0	0	0	0	6/12	N	0	0	0	0	0
40	Ammasi	30612	79	M	BL	CFCF	14.6	0	0	0	0	N	1	0	0	0	3	RTL	5	0	MC	1	0	1	0	OPEN	0	0	SICS	APHAKIA	1	1	1	1	1	1	1	1	1/60	I	1	1	1	0	0
41	Ayyavu	39527	76	M	UL	HM	17.3	0	1	1	0	N1	1	0	0	0	3	RTL	6	0	NSIV	1	0	0	0	OPEN	1	0	SICS	PCIOL	0	0	0	0	0	0	0	0	6/18	N	0	0	0	0	0
42	Marappan	40098	80	M	BL	1/60	20.6	0	0	0	0	N1	1	0	0	0	3	RTL	4	0	NSIV	1	0	0	0	OPEN	1	1	SICS	PCIOL	1	0	0	0	0	0	0	0	6/12	N	0	0	0	0	1
43	Saraswathy	41956	67	F	BL	3/60	17.3	0	0	0	0	N	1	0	0	0	3	RTL	8	0	NSII1PSC	1	0	0	0	OPEN	0	0	SICS	PCIOL	0	0	0	0	0	0	0	0	6/12	N	0	0	0	0	0
44	Kamatchi	45812	77	F	UL	CFCF	17.3	0	1	0	0	N	1	0	0	0	3	RTL	5	0	NSIV	1	0	0	0	OPEN	1	0	SICS	PCIOL	0	0	0	0	0	0	0	0	6/60	N	1	1	0	0	0
45	Rangasamy	49321	85	M	BL	HM	15.9	0	0	1	0	N	1	0	1	0	2	SRTL	5	0	MC	1	0	1	0	OPEN	1	0	SICS	APHAKIA	0	1	1	1	1	1	1	1	CFCF	N	0	1	0	0	0
46	Kannaiyan	50034	60	M	UL	5/60	12.2	0	1	0	0	N1	1	0	0	0	3	RTL	8	0	NSIII	1	0	0	0	OPEN	1	1	SICS	PCIOL	0	0	0	0	0	0	0	0	6/9	N	0	0	0	0	0
47	Anthoni	57682	75	M	BL	3/60	17.3	0	0	0	0	N1	1	0	0	0	3	RTL	5	0	NSIV	1	0	0	0	OPEN	1	0	SICS	IOLIS	0	0	0	0	0	0	1	1	6/24	N	0	1	0	0	0
48	Muniappan	60067	77	M	UL	3/60	20.6	1	0	0	0	N	1	0	0	0	3	RTL	8	0	NSIV	1	0	0	0	OPEN	1	1	SICS	PCIOL	0	0	0	0	0	0	0	0	6/60	I	1	1	0	0	1
49	Maral	69321	78	F	BL	PL1	17.3	0	0	0	0	N1	1	0	0	0	3	RTL	4	0	MC	1	0	0	0	OPEN	0	0	SICS	PCIOL	1	0	0	0	0	0	0	0	6/12	N	0	0	0	0	1
50	Vellingiri	69923	78	M	BL	CFCF	14.6	0	0	0	0	N1	1	0	0	0	3	RTL	4	0	MC	1	0	0	0	OPEN	0	0	SICS	PCIOL	1	0	0	0	0	0	0	0	6/18	N	0	0	0	0	0