A STUDY ON SERUM ANTICARDIOLIPIN ANTIBODY IN PSEUDOEXFOLIATION

Dissertation submitted by

DR. N.KAVITHA

In partial fulfillment of the requirements for the degree of

MASTER OF SURGERY

IN

OPHTHALMOLOGY

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DEPARTMENT OF OPHTHALMOLOGY

PSG INSTITUTE OF MEDICAL SCIENCES & RESEARCH

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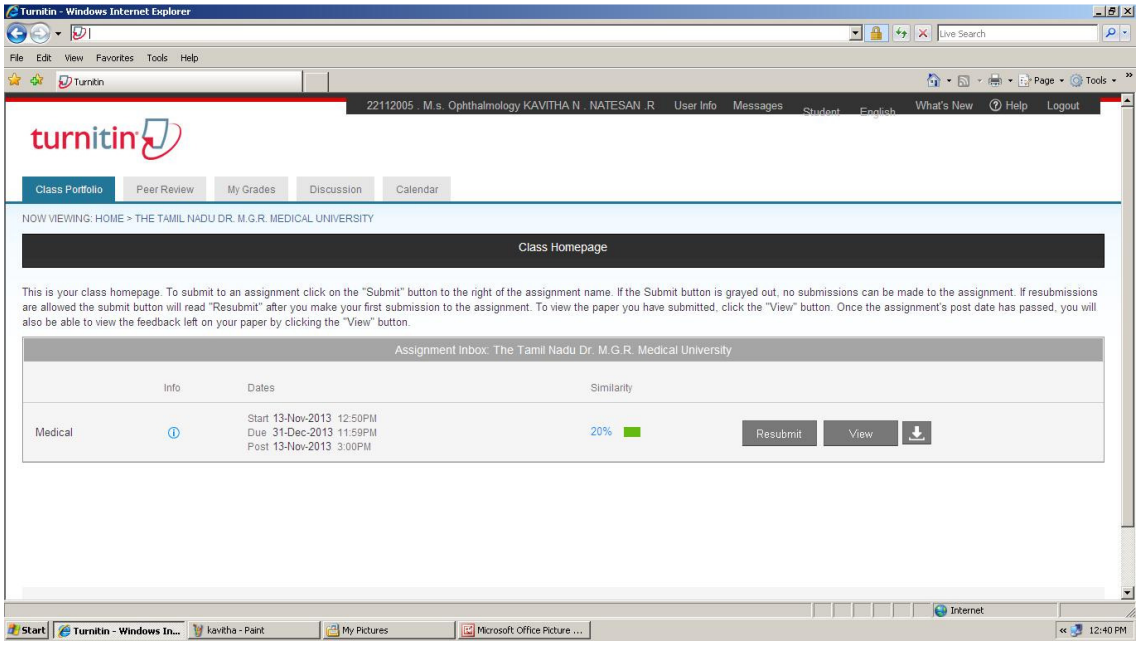
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TOPIC : A STUDY ON SERUM ANTICARDIOLIPIN ANTIBODY IN PSEUDOEXFOLIATION.

ABSTRACT:

AIM:

1) To evaluate the levels of anticardiolipin antibodies in patients with pseudoexfoliation and controls.

2) To assess the association between pseudoexfoliation and cardiovascular disease.

MATERIAL AND METHODS: This is a prospective study to evaluate the levels of anticardiolipin antibody in patients with pseudoexfoliation. This study included 30 patients with pseudoexfoliation and 30 healthly controls with comparable age and gender with no comorbities.

All patients underwent a complete ophthalmic examination , after pseudoexfoliation was diagnosed**.** Echocardiography was done to know the cardiovascular status of the patients in 2 groups.

Serum anticardiolipin antibodies IgG and IgM was done by using ELISA method in both cases and control groups.

Results:

We found elevated serum levels of anticardiolipin (IgG and IgM) antibody in patients with pseudoexfoliation. The mean level of acl IgG and IgM level in patients with pseudoexfoliation were statistically significant(p value<0.05).

Conclusions:

Elevated levels of anticardiolipin antibody is a risk factor for cardiovascular problems . Hence the attending ophthalmologist will be able to intimate the attending physician about the possible cardiac risk association.

KEY WORDS: Pseudoexfoliation, True efoliation, Anticardiolipin antibody, endothelial dysfunction.

TABLE OF CONTENTS

INTRODUCTION:

Pseudoexfoliation is characterised by the widespread deposition of whitish flaky material adherent to the ocular and extraocular tissues. Among the extraocular tissues, pseudoexfoliative fibres are seen in heart, lungs, skin, gallbladder, blood vessels. In present years pseudoexfoliation has been shown to be a systemic process associated with cardiovascular disease.

Since its discovery pseudoexfoliation syndrome has undergone extensive research for its unique distribution and pathological changes in the eye.

Being more common in elderly it causes a variety of ocular and systemic manifestations. These patients are at higher risk of developing glaucoma, corneal endothelial cell loss, sphincter atrophy of the iris , poor mydriasis, iris neovascularization , transillumination defects, zonular dialysis and spontaneous dislocation of lens.

Studies suggested a vascular endothelial involvement seen in pseudoexfoliation. Vascular occlusions has also been common in patients with pseudoexfoliation. Endothelial dysfunction has an important contributory role.

Antiphospholipids are immunoglobulins belonging to a group of autoantibodies directed against phospholipids & phospholipid protein complex in all membranes. The presence of high level of antiphospholipids has been associated with various systemic thromboembolic and ophthalmic conditions such as anterior ischemic optic neuropathy, amaurosis fugax and retinal and choroidal vascular occlusions. Anticardiolipin and lupus anticoagulant are together referred to as antiphospholipid antibodies. Lupus anticoagulant antibodies are mainly to detect systemic lupus erythematous. Pseudoexfoliation and anticardiolipin antibodies share a common associations in various ocular and systemic conditions. We therefore aim to evaluate the levels of anticardiolipin antibodies in patients with pseudoexfoliation and in controls.

REVIEW OF LITERATURE:

In 1917, Lindberg was the first person to describe pseudoexfoliation. Exfoliation is the most common identifiable cause of open angle glaucoma worldwide and called as pseudoexfoliative glaucoma (PXG). It is a systemic disorder with important eye manifestations including development of open and closed angle glaucoma, cataract with zonular instability . Pseudoexfoliation is more common in older age groups, with most occurring in the late 60s and early 70s.The condition may be unilateral or bilateral. It is more prevalent in the Scandinavian countries.

It has been estimated that more than 60 to 70 million people in the world are affected and the risk of glaucoma increases 5% at 5 years and 15% at 10 years . The prevalence of pseudoexfoliation increases steadily with age in all populations. About two third of patients have clinically unilateral involvement, and subsequently showed bilateral involvement later in life .It can be diagnosed prior to the clinically visible appearance of exfoliative material by conjunctival biopsy, showing that the disease is present microscopically even before it is detected clinically in the fellow eye.

True exfoliation

In capsular delamination, superficial layer of lens capsule separate from the deeper layers to from scroll like margins and floats in the anterior chamber as thin , clear membrane.

Elschnig first described capsular delamination as glass blower cataract and subsequently found that exposure to infrared radiation was responsible for it.

Capsular delamination is uncommon, because of the widespread use of protective goggles by the exposed workers. Glaucoma is not a common feature in true exfoliation

Pseudoexfoliation syndrome (PXS) is characterized by the widespread deposition of whitish flaky material on many ocular and extraocular tissues. Other terms used are senile exfoliation syndrome, glaucoma senilis, complex pigmentory glaucoma, exfoliation of the pseudocapsule and senile uveal exfoliation. Exfoliation material is produced by basement membrane of all tissues and is composed of microfibrils such as elastin, tropoelastin, amyloid P, proteoglycan and transforming growth factor. Exfoliative material is seen in many cell types in anterior segment including conjunctiva, lens capsule epithelium, corneal endothelium and Schlemn canal endothelium. Extra ocular sites are extra ocular muscles, orbital septa, posterior ciliary arteries, vortex veins and central retinal vessels. Being a systemic disorder it has also been

demonstrated in tissues throughout the body like lungs, heart, liver, gall bladder, skin, kidney and cerebral meninges, suggesting a systemic process involving generalized abnormal elastin metabolism. Histologically pseudoexfoliative material has been demonstrated in aorta and peripheral arteries [8].

ETIOLOGY AND PATHOGENESIS:

Genetic basis responsible for PXF include familial aggregation , transmission in two generation families, higher concordance rates in monozygous twins, relatives of affected patients. Recently LOX1 gene is responsible for formation of elastic fibres in Pseudoexfoliation. However, a number of non genetic factors are also responsible for exfoliative material which includes dietary factors, autoimmunity, infectious agents and trauma. These factors has been hypothesized , but have not been proven[2].

Altogether, Pseudoexfoliation represents a complex, multifactorial, late onset disease with genetic and nongenetic factors involved in the pathogenesis.

The key pathogenetic factors involved are microfibrillopathy involving transforming growth factor-1, oxidative stress and impaired cellular protection mechanism.

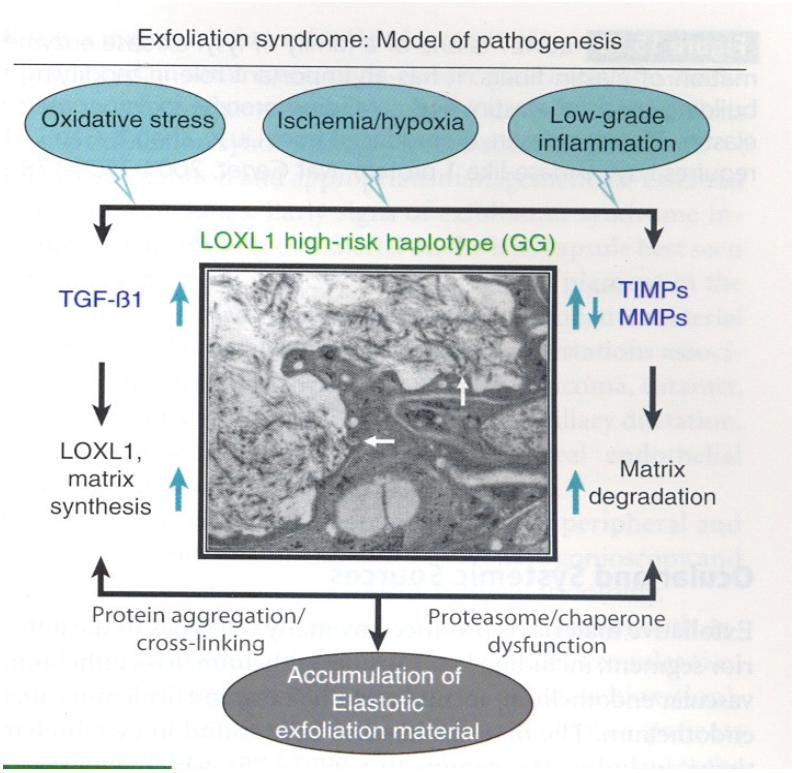
Current concepts of the pathogenesis of exfoliation syndrome

1) LOX1 gene plays an important role in modifying tropoelastin, the basic building block of elastin and cause protein aggregation leading to accumulation of elastotic exfoliation material.

2) Oxidative stress induced elastosis, an elastic microfibrillopathy associated with the excessive production of elastic microfibrils leads to increased matrix synthesis.

3) Imbalance between matrix metalloproteinase and transforming growth factor beta 1 will cause aggregation, cross linkage, increased matrix degradation leading to matrix accumulation in pseudoexfoliation[1].

Figure 1: Exfoliation syndrome pathogenesis



CORNEAL CHANGES

Flakes of exfoliative material and pigment accumulation can be seen on the corneal endothelium scattered diffusely or in the form of a vertical spindle similar to the Krukenberg spindle in pigment dispersion syndrome. Specular microscopy of corneal endothelium has revealed a lower cell density in pseudoexfoliation eyes and found that exfoliative material was formed by degenerative endothelial cells. It has also been suggested that corneal endotheliopathy in patients with exfoliation syndrome can give rise to guttate appearance[1].

LENS, ZONULE, CILIARY BODY CHANGES

The characteristic appearance of exfoliative material on the anterior lens capsule has three distinct zones.

Zone.1 is a translucent central disc with occasional curled edges,

Zone-2 is a clear zone corresponding to contact with the moving iris and

Zone-3 is a peripheral granular zone.

Nuclear cataract occurs frequently in eyes with exfoliative syndrome. However studies found no association between cataract and exfoliation. Involvement of the zonules can lead to lens subluxation and phacodonesis. This instability of the zonules are due to deposition of exfoliative material on the zonules between non pigmented ciliary epithelial cells and at the preequatorial region of the lens.

Proteolytic enzymes in the exfoliative material may facilitate zonular disintegration. These alterations can lead to lens subluxation and phacodonesis. During cataract surgery patients with pseudoexfoliation are prone to have many complications like iridodialysis, poor mydriasis, vitreous loss and post operative complications like decentration of intraocular lenses , capsule contraction syndrome and posterior capsular opacification[1].

FIGURE 2: Exfoliation syndrome is demonstrated by three distinct zones on the anterior lens capsule Zone-1-A translucent central disc with occasional curled edges, Zone-2 a clear zone corresponding to contact with the moving iris and Zone-3 a peripheral granular zone.

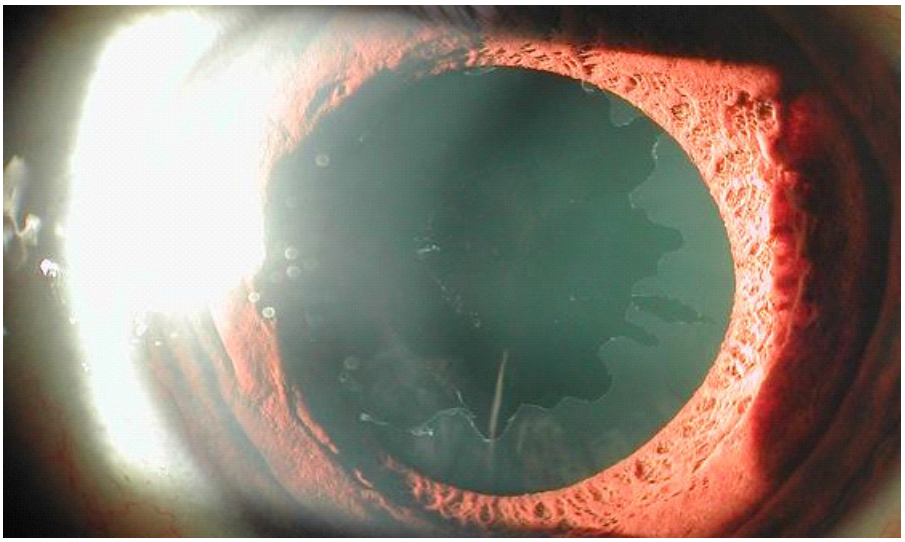


Figure 3: Exfoliation material - Based on the morphologic alterations of the anterior lens capsule.

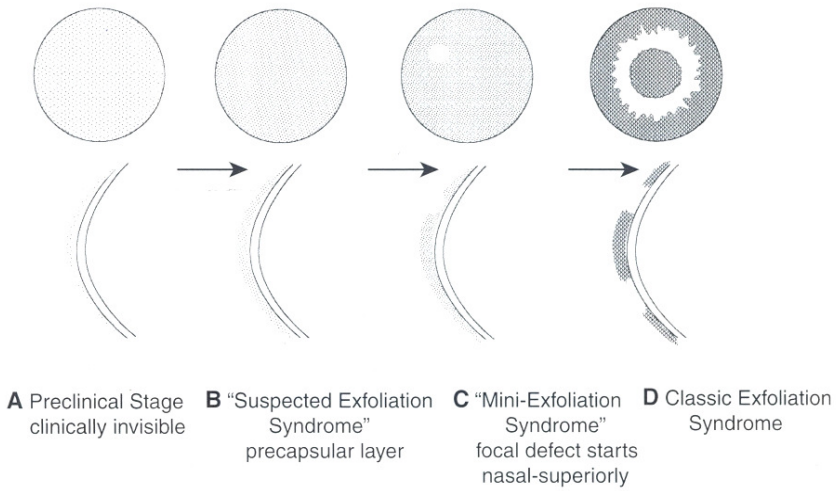
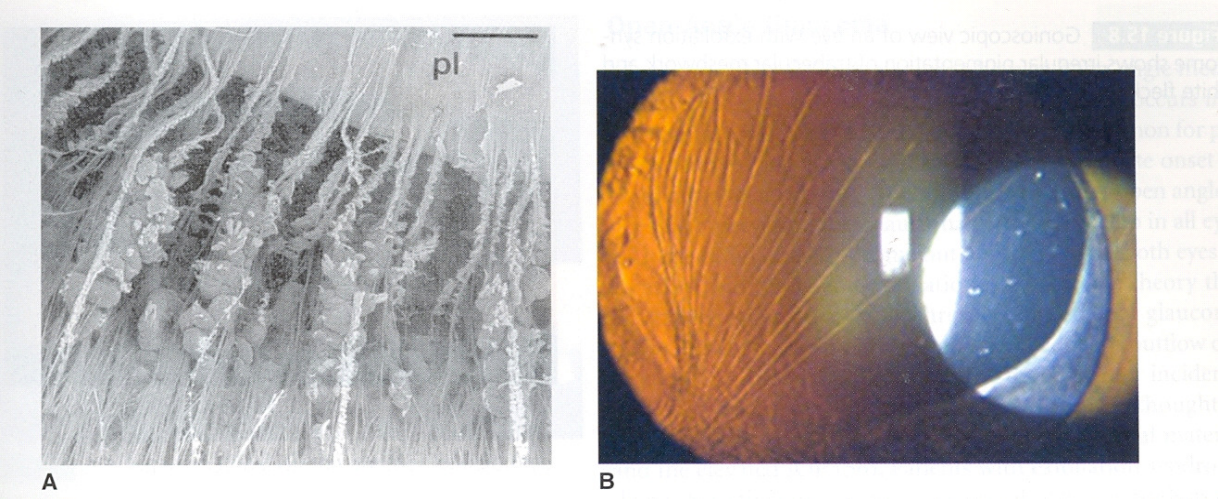


Figure 4: EXFOLIATION SYNDROME ZONULOPATHY. A: Scanning electron micrograph shows an accumulation of exfoliation material in the region of the ciliary process. B: Exfoliation syndrome created zonular tension during surgery so that the posterior capsule tension is flaccid, which makes incomplete cortex removal .



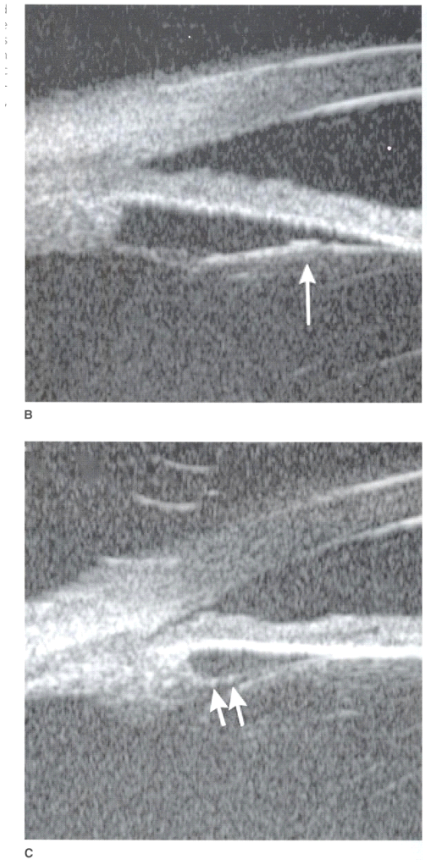
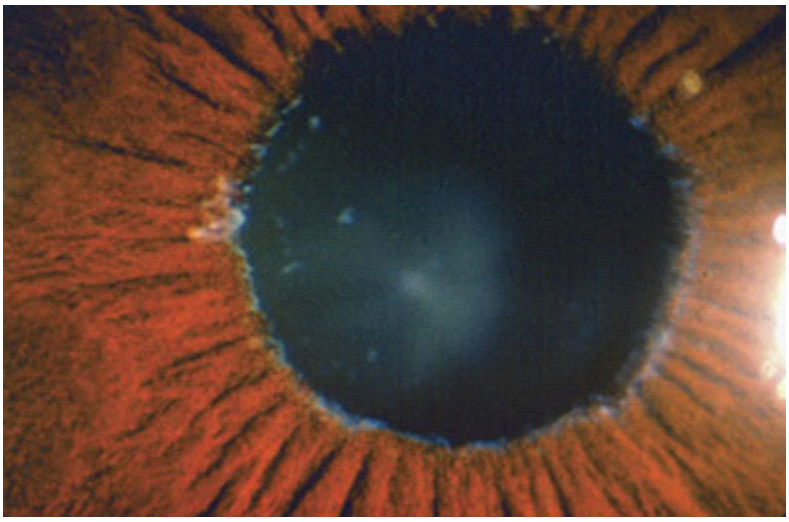


Figure 5: Uneven or disrupted zonules with peripheral lens accumulation of exfoliative material B: patchy deposits on zonules characteristic of exfoliation syndrome.

IRIS CHANGES

Pseudoexfoliative material is also seen as white flecks on the pupillary margin of the iris, with loss of pigment at the pupillary ruff. Iris transillumiation typically reveals a moth eaten pattern near the pupillary sphincter. Ultrastructural studies suggest that hypoperfusion due to abnormal extracellular matrix is a contributory factor in the development of pseudoexfoliation syndrome. Subsequently atrophy of the pigment epithelium, and dilator muscle cells account for the poor mydriasis which is also typical finding in pseudoexfoliation[1].

Figure 6: Exfoliative material at pupil border



GONIOSCOPIC FINDINGS

The pseudoexfoliation is associated with excessive pigment dispersion, leading to increased trabecular meshwork pigmentation. The pigmentation seen in pseudoexfoliation is uneven than that seen in pigmentary glaucoma. Iris scrapes the exfoliation material on the anterior lens surface which causes the release of pigment epithelial cells in iris with concomitant dispersion of pigments into the anterior chamber which leads to loss of pupillary ruff, iris sphincter transillumination and increased trabecular pigmentation. Pigments are also seen along the Schwalbe's line and termed as Sampaolesi line.

Ultrastructural studies suggest that progressive accumulation of exfoliative material in angles leads to swelling and disorganization of juxtacanalicular meshwork and gradual narrowing of the schlemn canal.

Anterior chamber depth was found to be normal in most eyes in pseudoexfoliation syndrome[1].

Figure 7: Gonioscopic view of an eye with exfoliation syndrome shows irregular pigmentation of trabecular meshwork and white flecks of exfoliative material.

COURSE OF GLAUCOMA

The risk of glaucoma increases 5% at 5 years and 15% at 10 years in patients with pseudoexfoliation. The incidence of glaucoma in exfoliation syndrome is around 22 to 49%. According to the Early Manifest Glaucoma Trial (EMGT) patients with ocular hypertension and exfoliation syndrome were at twice a risk of conversion to glaucoma when compared with age matched controls without pseudoexfoliation[2].

Mechanism of Open angle glaucoma

Most eyes with pseudoexfoliative glaucoma have an open angle mechanism , although acute angle closure glaucoma also occurs in an small number of cases. The gene responsible for glaucoma in pseudoexfoliation is LOXL 1 gene. Mechanism of intraocular pressure elevation in glaucoma are due to passive deposition of exfoliative material and endothelial damage in the trabecular meshwork which leads to increased resistance to aqueous outflow[1].

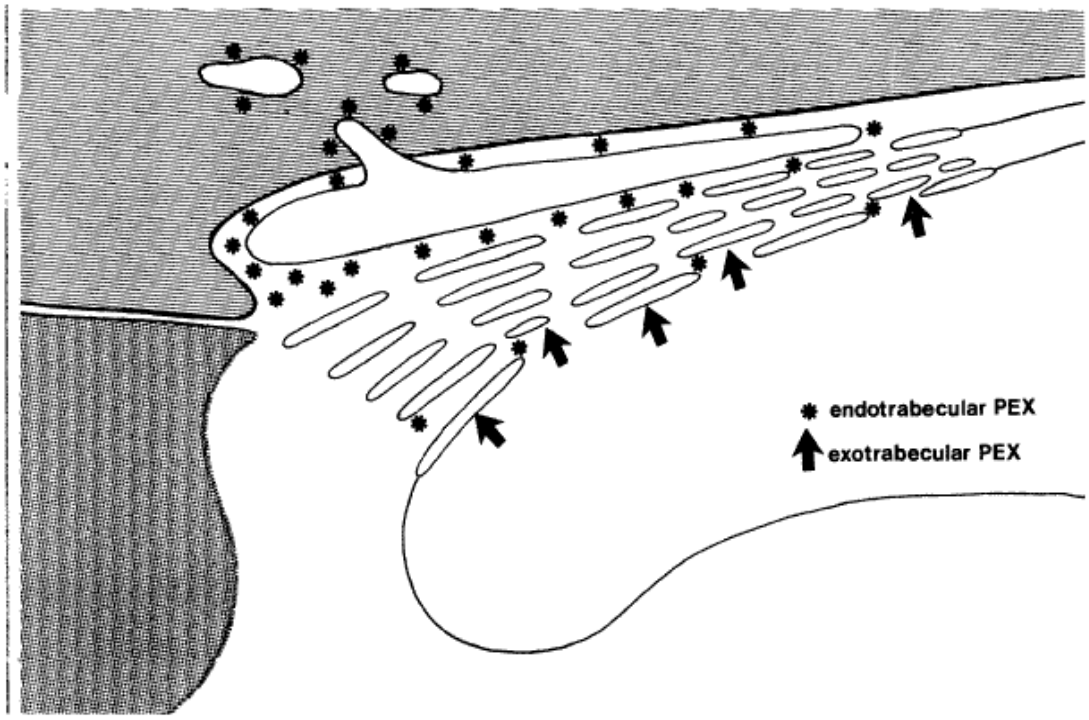
ANGLE CLOSURE GLAUCOMA

A less common mechanism of acute or chronic angle closure glaucoma are due to pupillary block including zonular weakness causing anterior movement of the lens, increased adhesiveness of the iris to the lens due to exfoliative material, sphincter muscle degeneration, uveitis and iris rigidity due to hypoxia[1].

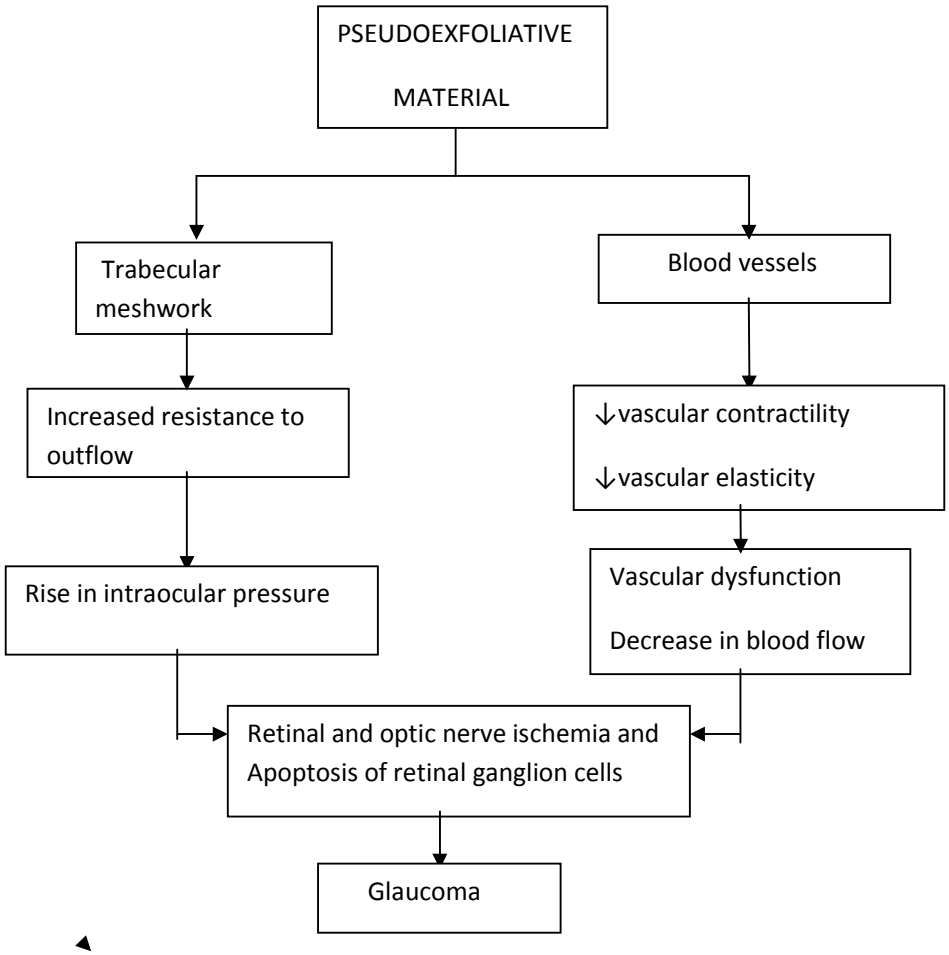
ACUTE INCREASES IN INTRAOCULAR PRESSURE

Patients with open angles and exfoliation syndrome may present with acute angle angle closure glaucoma[1].

Figure 8: Schematic diagram of the trabecular meshwork shows localization of exfoliation material in endotrabecular and exotrabecular meshwork.



PATHOGENESIS OF PSEUDOEXFOLIATIVE GLAUCOMA



OCULAR ASSOCIATIONS

Exfoliation syndrome is associated with ocular and systemic vascular abnormalities. Retinal vein occlusion has been associated with PEX. In a retrospective study 73 eyes of 70 patients with branch retinal vein occlusion (BRVO), 53 eyes of 49 patients with central retinal vein occlusion (CRVO) were studied. Pseudoexfoliation was present in 6 of 73 eyes (8.2% BRVO), 11 of 53 eyes with central retinal vein occlusion (20.8%) and 20 of 384 age matched controls (5.2%).

Possible mechanism of central retinal vein occlusion in Pseudoexfoliation:

1) Involvement of the retinal vasculature by the pseudoexfoliative process leads to hypoperfusion that can lead to thrombosis of central retinal vein[3].

Cursiefen et al ,reviewed the records of 332 patients with branch retinal vein occlusion and 159 patients with central retinal vein occlusion for the presence of pseudoexfoliation syndrome. The PXS was seen in 20% of patients with branch retinal vein occlusion and 27% in central retinal vein thrombosis. Venous thrombosis could be a causative risk factor for retinal vein thrombosis in pseudoexfoliation [4].

STUDIES SHOWING SYSTEMIC ASSOCIATIONS IN PSEUDOEXFOLIATION.

Patients with pseudoexfoliation had increase chances of decrease in blood flow velocities in meningeal artery, carotid artery, ophthalmic artery, and central retinal artery, leading to cardiovascular and cerebrovascular disease [5].

Recently higher Homocysteine concentration in aqueous, tear fluid and plasma has been documentated in PEX patients[6].

- Tranchina L et al screened 36 patients with PEXS, 40 with primary open angle glaucoma(POAG) and 40 age matched controls. Plasma Homocysteine concentrations, serum vitamin B12 and folic acid levels analysed by competitive chemiluminescent enzyme immunoassay were done for these patients. The plasma homocysteine levels exceeding 14 ml/l were considered elevated. They reported that ,plasma homocysteine was significantly higher in PXG compared with POAG and controls and concluded that hyperhomocysteinemia can be an independent risk factor for vasculopathy in pseudoexfoliation patients[6].
- Lovro Bojic et al studied 21 patients with PEX glaucoma and 24 controls . Two dimensional and pulsed Doppler echocardiography was performed . 21 patients had reduced diastolic filling parameters i.e Ejection fraction (EF), ventricular filling during diastole, velocity time integral E wave and A wave. However systolic function of EF and fractional shortening were

not statistically significant between pseudoexfoliative glaucoma and the controls. The presence of pseudoexfoliative material in the myocardial cells and basement membrane causes prolonged relaxation of left ventricle [7].

- Pinar Tuna et al conducted a prospective study of 23 patients with pseudoexfoliation syndrome and 20 healthy age matched controls. Out of 23 patients, 11 patients had pseudoexfoliative glaucoma. Patients who had a history of myocardial infarction, angina pectoris, left ventricular dysfunction, heart failure, stroke, cerebrovascular disease, current smoking, diabetes mellitus were excluded from the study. All patients subjected to transthoracic echocardiography to evaluate left ventricular function and left ventricular wall thickness using a 2-4 MHz phased – array scanner.

  Arterial endothelial function of the brachial artery was assessed by brachial artery ultrasound after a 12 hour fasting and resting of 15 minutes . Vascular response to reactive hyperemia (flow mediated dilation) and sublingual nitroglycerin (NTG mediated dilation) were measured.

  Endothelial dependent FMD and NTG mediated dilation were significantly lower in the pseudoexfoliation than in control groups[8] .

This study suggest that presence of pseudoexfoliative material in the adventitial and subendothelial connective tissuse leads to arterial endothelial dysfunction and lower vascular response in arterial system[8].

TREATMENT OPTIONS

Glaucoma associated with exfoliation syndrome can be particularly challenging to manage. Care should be taken while setting the target pressure because intra ocular pressure can fluctuate.

The sole focus of therapy in PEX should not be the reduction of intraocular pressure. The initial approach to medical therapy of PEX has been similar to that of POAG. Pseudoexfoliatiove glaucoma is more difficult and resistant to treat as compared to primary open angle glaucoma. Medical therapy includes topical prostaglandins analogues (Bimatoprost, Latanoprost and Travoprost) and aqueous suppressants[2].

Excellent response has been reported for prostaglandin analogues and laser trabeculoplasty.

In recent crossover trial comparing Latanoprost to Bimatoprost , Bimatoprost has 35% reduction and 31% reduction in Latanoprost. In another 24 hour study Travoprost provided a slightly greater hypotensive effect than Latanoprost.

Konstas et al demonstrated that the reduction of 17 mmHg target intra ocular pressure (IOP) is necessary to prevent progressive damage[2].

Aqueous suppressants may lower IOP but do not interfere much with the progression of trabecular damage.

Cholinergic agents have multiple beneficial actions in pseudoexfoliation by increasing aqueous outflow thereby clearing the trabecular meshwork . Theoritically, miotics should be the first line of treatment[2].

An international, multicentric institutional prospective trial (ICEST) is currently comparing latanoprost and 2% pilocarpine versus timolol and cosopt(Dorzolamide and timolol) for patients with Pseudoexfoliation and ocular hypertension or glaucoma[2].

Because of the strong association with elevated homocysteine levels one must also consider, supplementing vitamins B_6, B_{12} and folic acid in patients with pseudoexfoliation[6].

LASER THERAPY

Argon laser trabeculoplasty (ALT) is useful if baseline IOP is higher than in eyes with Primary open angle glaucoma. ALT can delay the use of medical therapy for upto 8 years. A gradual reduction in success rate is also noted [2]

SURGICAL THERAPY

In recent study trabeculectomy with mitomycin C obtained better 24 hours IOP control in advanced PEX and POAG. However surgical complications are more common in PEX patients[1].

Cataract and Pseudoexfoliation

*Poor pupillary dilatation and occasional posterior synechiae

* Preoperatively zonular dialysis , phacodonesis, reduced endothelial cell density

PRATICAL TIPS DURING CATARACT SURGERY

* Large capsulorrhexis should be made to minimize zonular stress, and also to prevent phimosis.

*During hydrodissection tap the center of the nucleus to decompress the fluid pressure on a weak posterior capsule.

*If zonular weakness is present capsular tension ring is used intraoperatively[1].

Differential diagnosis:

The exfoliation syndrome must be differentiated from other forms of lens exfoliation

- Capsular delamination
- Primary amyloidosis
- Pigment dispersion

Pigment Dispersion

Pigment granules are dispersed throughout the anterior segment but is seen primarily on the cornea and iris. Iris transillumination is a valuable diagnostic feature of pigmentary glaucoma. The characteristic appearance is a radial stroke like pattern in the mid periphery of the iris.

Primary Amyloidosis

This is a generalised , systemic disorder which may be familial or nonfamilial. The amyloid may be deposited as a white flaky substance in pupillary margin of the iris, anterior lens capsule and the anterior chamber angle creating a clinical picture that resembles the exfoliation syndrome.

Capsular delamination

True exfoliation differs from pseudoexfoliaton by the underlying precipitating factor such as uveitis, exposure to intense heat and trauma. It has a thin, clear membrane separating from the anterior lens capsule, which often curls at the margins. Glaucoma occurs infrequently with capsular delamination.

ANTIPHOSPHOLIPID ANTIBODY

Antiphospholipid antibodies (APL) are immunoglobulins, belonging to a group of a heterogenous autoantibodies directed against phospholipids complexes which are the main constituents of all membranes. These antibodies are anticardiolipin, lupus anticoagulant and anti β_2 glycoprotein. Antiphospholipid antibody is tested by using solid phase ELISA assays (anticardiolipin antibodies) and liquid phase coagulation assays (lupus anticoagulant). Normal value of anticardiolipin antibody immunoglobulin G and M are 12Gpl-u/ml and 12Mpl-u/ml[4]. A combination of two positive tests in two separate occasions at least 6 weeks apart is usually required to confirm the diagnosis.

Antiphopholipid antibody has been found in arterial and venous thrombosis, SLE, thrombocytopenia and recurrent abortion. If it is present in the absence of any of these disorders it known as the primary antiphospholipid antibody syndrome[9] .

The Antiphospholipid syndrome is one of the most common risk factor for thrombosis. It results from formation of antibodies that are directed against beta 2 glycoprotein or other phospholipid binding protein such as prothrombin, protein S and thrombomodulin.

The term antiphospholipid was first demonstrated ,when it reacted with antigens in patients with syphilis and was detected by Wasserman reaction and VDRL. Later, IgG and IgM were demonstrated in the lupus anticoagulant which

reacted with the phospholipid portion of the prothrombin converting complex in the coagulation cascade to cause prolongation of activated partial thromboplastin time[10].

It was recently considered that the lupus anticoagulant and anticardiolipin antibodies are collectively referred as antiphospholipid antibodies[10].

IgG antiphospholipid was commonly associated with various ocular and vascular occlusions**.**

OPHTHALMIC FEATURES AND ANTIPHOSPHOLIPID ANTIBODY

The prevalance of vascular occlusive features in patients with positive antiphospholipid antibodies was 33%. However Giordano suggested that antiphospholipid antibodies have no role in ocular vascular occlusion[11].

OCULAR MANIFESTATIONS

ANTERIOR SEGMENT FINDINGS

Conjunctival telangectasia

Episcleritis

Scleritis

Dry eyes

Iris rubeosis

POSTERIOR SEGMENT FINDINGS

Venous stasis retinopathy

Venous tortuosity

Cotton wool spots

Retinal hemorrhages

Retinal edema

Retinal vein occlusion

Retinal artery occlusion

Optic neuropathy

Vitreous hemorrhage

Retinal neovascularisation

Vasculitis

NEURO OPHTHALMOLOGICAL MANIFESTATIONS

Transient visual obscurations

Amaurosis fugax

Etiology of APLA

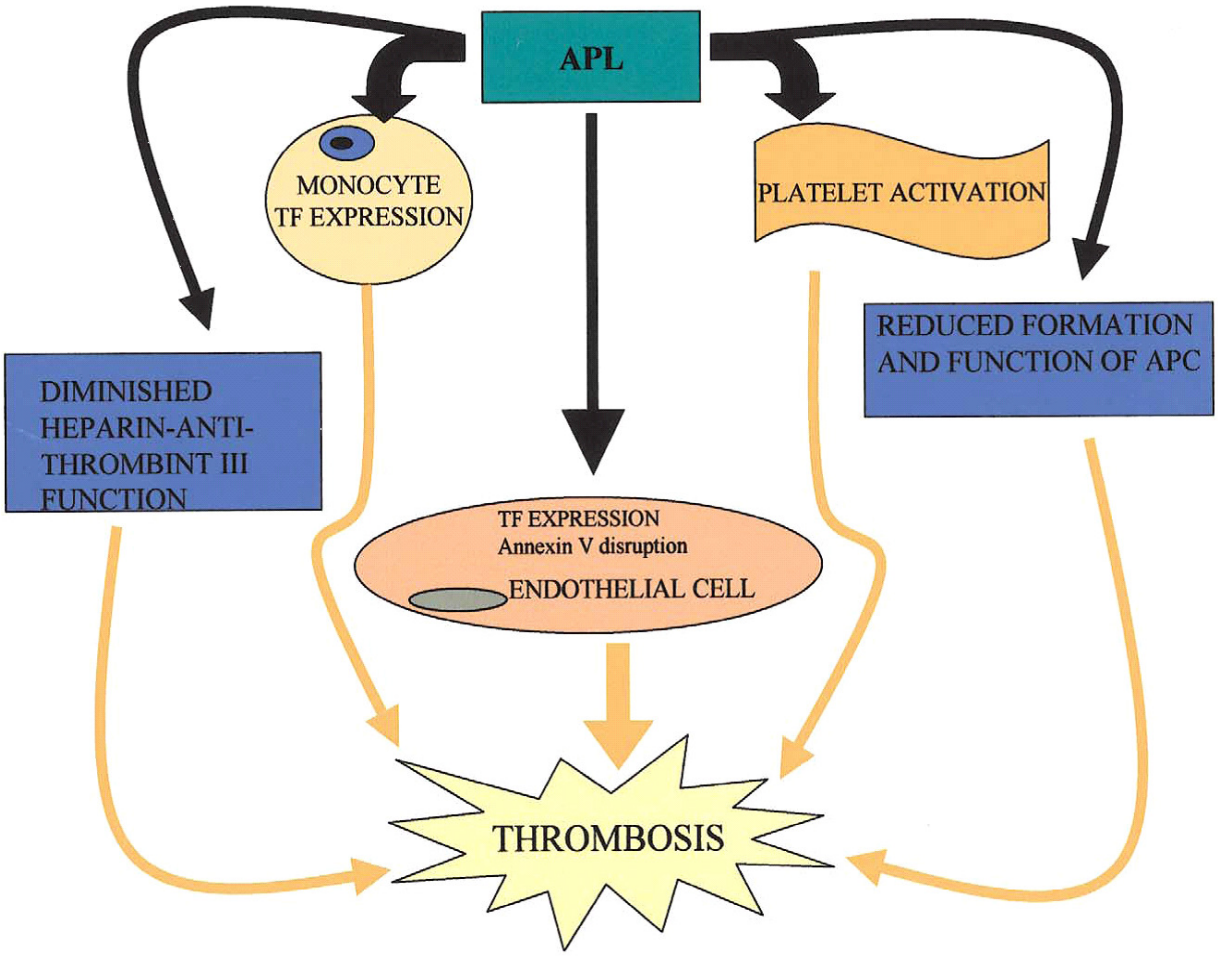
Apoptosis , a programmed cell death has recently been reported in the etiological mechanisms in antiphospholipid antibody syndrome.

Endothelial cell activation is induced by thrombotic factors like production of nitric oxide, prostacyclin, tissue plasminogen activation, platelet activation and heparin like prostaglycan. R Del Papa et al strongly suggests that APL antibodies will bind with endothelial cells of beta 2 glycoprotein -1 resulting in

increased adhesiveness of leukocytes, platelets and diminished heparin-antithrombin III function leading to thrombosis.

Endothelial dysfunction play an important role in the development of thrombosis in Antiphospholipid antibody syndrome[10].

Figure 9: Pathogenesis of Antiphopholipid antibody



Laboratory approach to antiphospholipid antibody detection

Testing stage and Method of detection

Initial testing: The first step is prolongation of coagulation in atleast one phospholipid dependent in vitro coagulation assays with the use of platelet poor plasma. These assays can be subdivided according to the portion of the coagulation cascade.

- ✓ The extrinsic coagulation pathway
- ✓ The intrinsic coagulation pathway
- ✓ The final common coagulation pathway

Mixing: The second step is a feature to correct the prolonged coagulation time by mixing the patients plasma with normal plasma.

Correction/ Neutralisation: The third step is confirmation of the presence of lupus anticoagulant antibodies by shortening or correction of the prolonged coagulation time after the addition of excess phosholipid or platelets that have been frozen and the thawed.

Exclusion: The fourth step is ruling out other coagulapathies with the use of specify factor assay if the confirmatory test is regulation or if a specific factor inhibition is suspected.

NEED FOR THIS STUDY:

Elevated Antiphospholipid antibody level is a risk factor for various systemic and ocular disease. Ocular conditions like retinal vein occlusions, retinal neovascularisation, amaurosis fugax, ischemic optic neuropathy and systemic conditions like myocardial infarction, coronary ischemia and pulmonary embolism. Endothelial dysfunction is an important contributory role in anticardiolipin antibodies.

Being a systemic disease, it can be identified in many extraocular structures such as heart, blood vessels, optic nerve, cerebral meninges and associated with stroke, asymptomatic myocardial dysfunction and systemic endothelial dysfunction .

Pseudoexfoliative material in myocardium causes the dysfunction of endothelium which leads to increased cardiovascular risk in patients with pseudoexfoliation. When anticardiolipin antibodies bind to beta 2 glycoprotein in cell wall, endothelial dysfunction occurs, resulting in reduced heparin anti-thrombin III function, increased platelet activation and finally thrombosis.

We used anticardiolipin antibodies as an independent marker to elucidate the function of cardiovascular system.

So we evaluated the levels of anticardiolipin antibodies in patients with Pseudoexfoliation and in controls. Hence the attending ophthalmologist will be

able to intimate the attending physician about the possible cardiac risk association.

PART-2

AIMS OF THE STUDY

PRIMARY AIM:

1) To evaluate the levels of anticardiolipin antibodies in patients with pseudoexfoliation and controls.

2) To assess the association between pseudoexfoliation and cardiovascular disease.

Secondary Objective

1) To study the ocular diseases associated with pseudoexfoliation.

2) To correlate between ocular diseases and anticardiolipin antibody.

INCLUSION CRITERIA:

Patients with Pseudoexfoliation

EXCLUSION CRITERIA:

1) History of diabetes and hypertension

2) History of Bleeding disorders

3)History of long term use of diverse drugs like antiseizures drugs (phenytoin), antibiotics (amoxicillin) and hydralazine.

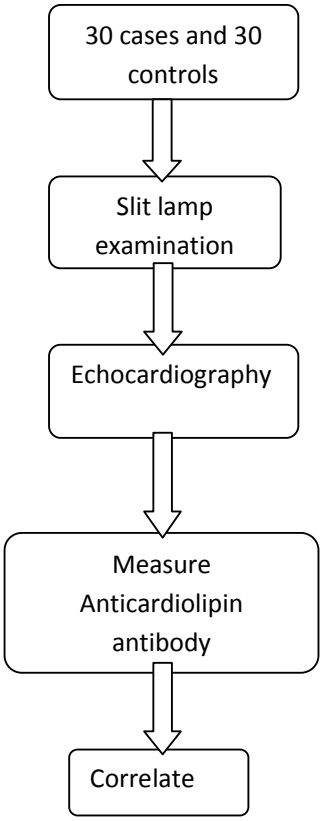
MATERIALS AND METHODS:

- This study includes 30 patients with pseudoexfoliation and 30 healthly controls in comparable age group and gender who attended the ophthalmology department in PSG during 2 years period.
- Patients with known case of cardiovascular disease like myocardial infarction, stroke, diabetes, hypertension ,bleeding disorders, long term use of diverse drugs like antiseizures drugs (phenytoin), antibiotics(amoxicillin) and hydralazine were excluded from the study because these disorders will elevate the anticardiolipin level in the blood.
- All patients underwent a complete ophthalmic examination including best corrected visual acuity, slit lamp examination, intraocular pressure by Applanation tonometry, angles by three mirror Goldmann goniolenses, and dilated fundus examination.
- PXS was diagnosed if slit lamp examination showed presence of Pseudoexfoliation material at the pupillary border , anterior lens capsule and Sampaolesi line on gonioscopy.
- Controls were matched to cases by age, sex to make the groups maximally comparable.
- Echocardiography was done to know the cardiovascular status of the patients in 2 groups.

- Serum Anticardiolipin antibodies will be estimated by using ELISA method in both cases and control groups.
- **ANTICARDIOLIPIN ANTIBODY**:

  3ml of Venous blood samples were obtained. Anticardiolipin antibodies (IgG and IgM) were measured by enzyme-linked immunosorbent assay.

  IgM and IgG results were classified as positive(>12 GPL/Ml) or negative (<12GPL/ML).
- The study was approved by the ethical committee of our hospital and informed consent was obtained from all the patients included in the study. Results of IgG and IgM in cases and controls groups were statistically analysed using software SPSS version. Statistical analysis of continuous data were made using student *t* test. A *p* value of less than 0.05 was considered significant.


30 cases and 30 controls
Slit lamp examination
Echocardiography
Measure Anticardiolipin antibody
Correlate

CASE SHEET PROFORMA:

Name:

Age:

Sex:

Address:

Presenting complaints:

H/o Presenting illness:

Past History:

1)Diabetes Mellitus

2)Hypertension

3)long term use of drugs

Systemic Examination:

Blood pressure-

Blood sugar-

Ocular Examination:

Visual acuity-

*Best corrected-

*Near Vision-

Eyelids and adnexa-

Conjunctiva-

Cornea-

Anterior Chamber-

Iris-

Pupil-

Lens-

Extraocular movements-

Posterior segment examination-

*Ophthalmoscopy-

Central corneal thickness by ultrasound pachymetrys:

Slit lamp examination:

Applanation tonometry

Gonioscopy

Investigations:

a) Echocardiography

b) Anticardiolipin antibody-

IgG

IgM

OBSERVATIONS AND RESULTS

Age distribution

Among the 30 patients who were enrolled in the study all the patients were more than 55 years of age and the average age of the patients was 63.82 years .

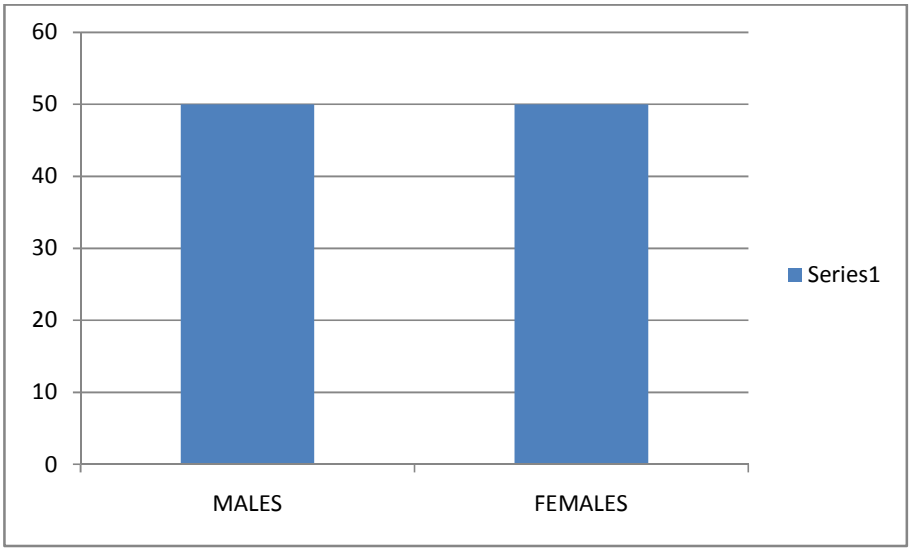
Table 1: Age distribution in pseudoexfoliation:

AGE IN YEARS	NO OF PATIENTS	PERCENTAGE
≥ 50	0	0
51-60	9	30
61-70	18	60
71-80	3	10

Sex distribution

Of the 30 patients, 15 patients were males (50%) and the remaining 15 patients were females (50%)

Bar diagram 1: Sex distribution



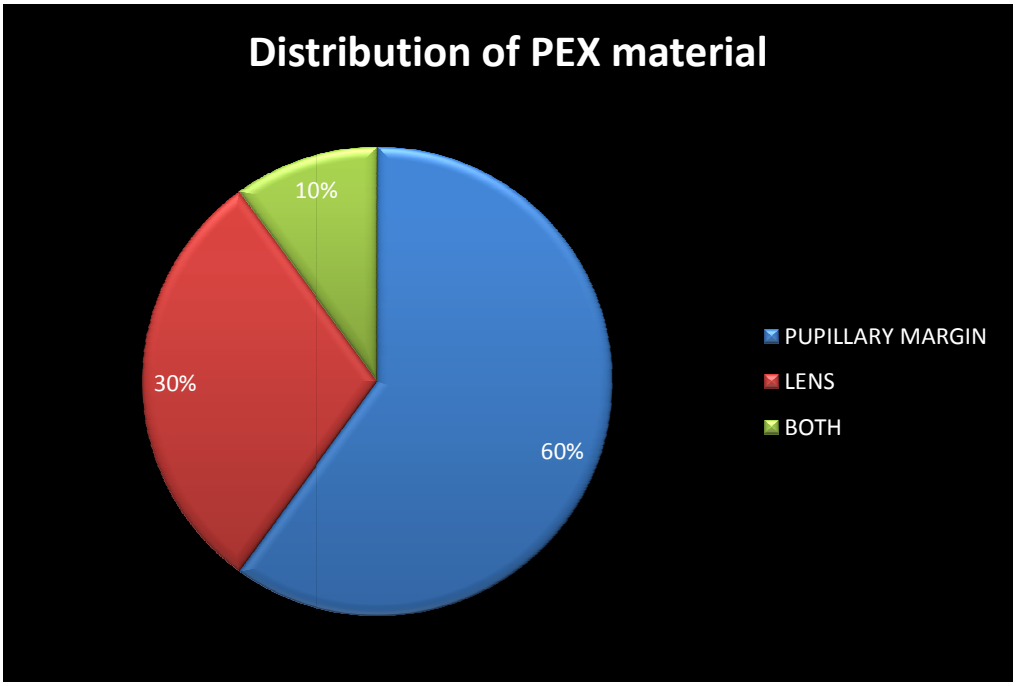
Laterality of pseudoexfoliation

(56.6%) of the thirty cases included in the study had unilateral pseudoexfoliation and the rest 13 (43.4%) had bilateral presentation. Hence the number of eyes with pseudoexfoliation is 43.

Distribution of pseudoexfoliation material

- 18 patients in the pupillary margin
- 9 patients in the anterior surface of the lens and
- 3 patients in the iris and lens.

Pie chart showing distribution of PEX material



Pseudoexfoliation in gonioscopy

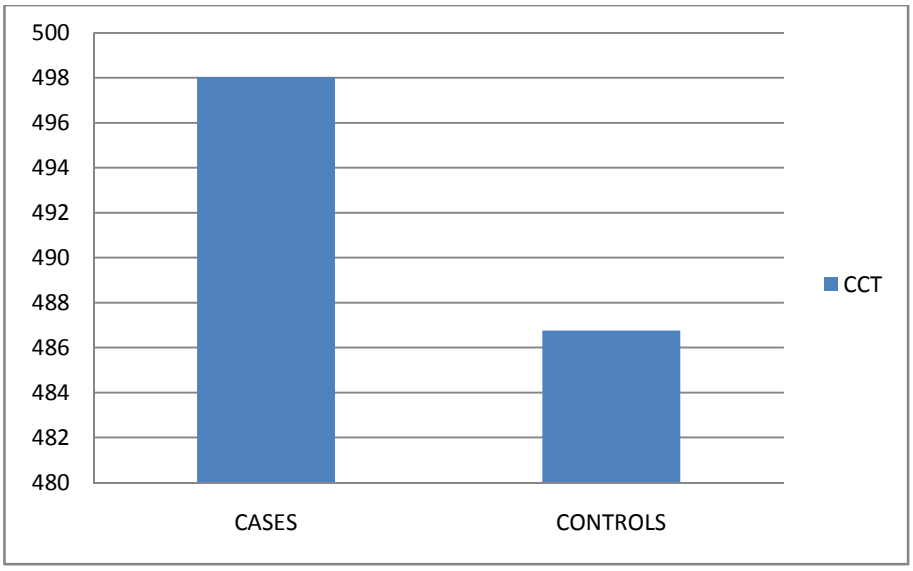
Of the 43 eyes with pseudoexfoliation 34 eyes (79%) had darkly pigmented trabecular meshwork and the remaining 9 (20.9%) had normal pigmentation.

Pseudoexfoliaton and central corneal thickness

The average central corneal thickness in eyes with pseudoexfoliation was 498.04mm

The average Central corneal thickness in eyes without pseudoexfoliation was 486.75 mm

BAR DIAGRAM 2: CENTRAL CORNEAL THICKNESS

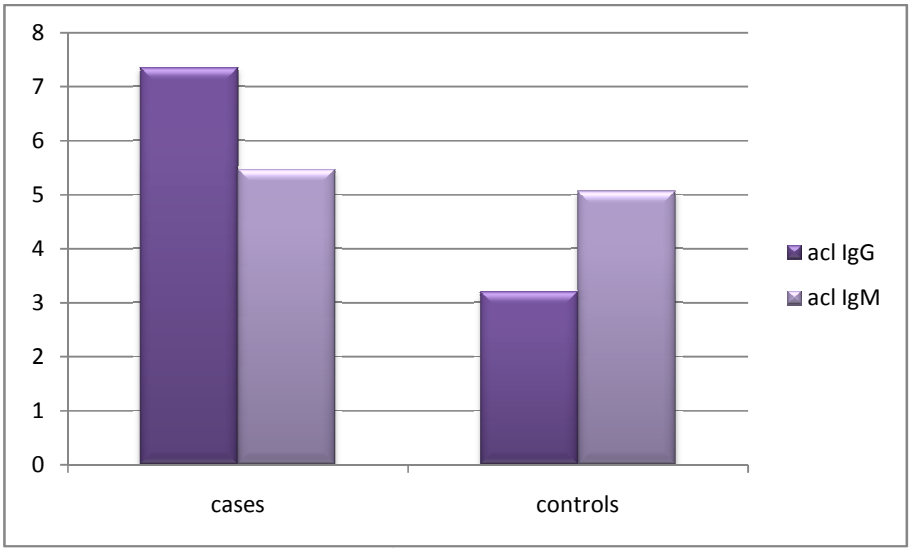


Pseudoexfoliation and Intraocularpressure

All the patients had intraocular pressure in the range of 12.3 ± 2.00 mmHg.

Pseudoexfoliation and antiphospholipid antibody

The anticardiolipin antibody (acl) IgM and IgG of groups are outlined in bar diagram 3:



The mean value of anticardiolipin IgG levels in pseudoexfoliation and controls groups were 7.35 and 3.20

Mean ± standard error of anticardiolipin antibody IgG levels in patients with Pseudoexfoliation were significantly higher than those of the controls ($p < 0.05$)

The acl IgG concentrations above the cut off value of 12GpL-U/ml were found in 10 of 30 patients (33.33%) with pseudoexfoliation

The mean value of acl IgM levels in patients with PEX and controls were 5.47 and 5.06 . Anticardiolpin IgM levels were found to be higher in patients with PEX than in the control groups. (p value < 0.01).

The level of anticardiolipin IgG and IgM was found normal in the control groups.

Statistical data of Anticardiolipin antibody levels:

Mean	Cases	Controls	P value
acl IgG	7.35	3.20	<0.05
acl IgM	5.47	5.06	<0.01

Anticardiolipin	CASES		CONTROLS		t	P value
	MEAN	SD	MEAN	SD		
IgG	7.35	4.18	5.06	2.30	2.62	<0.05
IgM	5.47	3.11	3.20	1.54	3.59	<0.01

Discussion:

Age and Sex distribution in pseudoexfoliation:

In the study conducted by Tarek A Shazly in Egypt , a population based study ,the prevalence of PEX syndrome increased progressively after 50 years.4% of cases between 40-49 years,45% between 60-69 years,59% between 70-79 years,11% between 80-89 years,2% between 90-99 years[12].

In another prospective Hospital based study by Rashad Q Rao in Pakistan ,the mean age of patients with pseudoexfoliation was 72.2 years. The prevalence was 2.6% in patients less than 70 years of age and increased to 13.04% in over 70 years of age[13].

All the above studies showed that pseudoexfoliation significantly increases with age above 50 years.

In this study 60% of cases were between 61-70 years of age, 30% were between 51-60 years, and the remaining 10% between 71-80 years of age.

Also this study consisted of 50% males and 50% females. All the studies showed no significance difference in sex predilection[14].

Laterality

Aravind et al in the study with 108 patients found that 53 (49.1%) had unilateral disease and bilateral in 55 (50.9%)[15].

Tarek A Shazly, reviewed records of 372 patients with PEX determined that 82.2% of cases had bilateral pseudoexfoliation[12].

Many studies showed that pseudoexfoliation was bilateral disease, which initially had unilateral presentation and subsequently bilateral involvement later after few months to years[16].

In a study conducted by Parekh et al, 32 Patients of unilateral pseudoexfoliation was screened by using transmission electron microscopy of conjunctival specimens and anterior lens capsule was obtained during cataract surgery. He concluded that there was a 81% chances of getting PEX in the unaffected eye ultrastructurally.

In present study 56.6% of cases showed unilateral involvement and 43.4% of cases had bilateral disease.

Distribution of pseudoexfoliation material:

According to a study by Thomas et al pseudoexfoliation was present in pupillary margin in 38 eyes (33.9%), on the lens in 71 eyes(63.4%), both locations in 26 eyes(23.2%) and in the trabecular meshwork in 1 eye (0.9%)[17].

According to a study by Rao VA and Kaliaperumal S, 95% of PEX syndrome can be successfully diagnosed prior to dilatation by the presence of PEX material in the pupillary ruff. In 18% of cases the material was found in pupillary ruff and in

100 % found in zone 3 or the peripheral band after dilatation**.**

In this study 18 eyes (60%) had in pupillary margin, 9 eyes (30%) on the lens after pupillary dilatation, and in both locations in 3 eyes(10%).

Pseudoexfoliation in Gonioscopy and intraocular pressure:

Aravind et al concluded that out of 108 patients with pseudoexfoliation,18 cases (16.7%) had high intraocular pressure (>21mmHg),16 cases (14.8%) had occludable angles, and 14 cases (13%) had pseudoexfoliative glaucoma[15].

Almost all studies showed PEX has been associated with raised intraocular pressure and glaucoma.

Kozart and Yanoff, in a clinical based study of 100 consecutive patients with Pseudoexfoliation, reported 15% prevalence of ocular hypertension and 7% prevalence of glaucoma, however raised intraocular pressure was due to PXF material blocking the trabecular meshwork causing open angle glaucoma and zonular weakness resulting anterior movement of the lens, increased adhesiveness of the iris to the lens leading to closed angle glaucoma[18].

In the present study of the 43 eyes with pseudoexfoliation 34 eyes had(79%) darkly pigmented trabecular meshwork and the remaining 9 eyes (20.9%) had normal pigmentation. None of the patients had glaucoma.

Pseudoexfoliation and central corneal thickness:

A.C Ventura et al studied central corneal thickness with normal tension glaucoma, POAG, pseudoexfoliative glaucoma, ocular hypertension and in controls. The mean CCT was higher in patients with OHT than in normal individuals , however there was no significant differences between the later four groups[19].

Hepsen et al measured central corneal thickness in eyes with pseudoexfoliation syndrome and they found that the mean Central corneal thickness was not statistically significant compared to the controls, but the mean CCT in PEX glaucoma was significantly reduced when compared to normotensive PEX eyes[20].

Here the average CCT in eyes with PEX was 498.04mm and in controls was 486.75mm revealing no significant change from normal CCT.

PSEUDOEXFOLIATION AND ANTIPHOSPHOLIPID ANTIBODY:

In this study , we found elevated serum levels of anticardiolipin (IgG and IgM) in patients with pseudoexfoliation than in controls. The increase in mean levels of acl IgG and IgM level in patients with pseudoexfoliation were statistically significant.

Antiphospholipid antibodies were originally described in Systemic Lupus Erythematosus. Later, these antibodies were also found in the absence of a systemic autoimmune disorder[21].

Recently published data showed raised anticardiolipin antibodies results in thrombosis through a variety of prothrombotic mechanism including endothelial dysfunction, platelet and fibrinolytic activation.

Some studies suggest that PXS has been associated with cardiovascular and cerebrovascular disease and thrombotic ocular complications like central retinal artery occlusions.

Tsakiris et al, found no significant difference between anticardiolipin levels in patients with normal tension glaucoma and POAG and controls[22].

Latalska et al, evaluated antiphospholipid antibodies in serum and aqueous humour in 19 patients with POAG, 18 with POAG, and 11 with PEXG. Plasma and aqueous fluid are collected and IgG , IgM were measured using ELISA method. The significant differences were observed in levels of IgG in serum

(p=0.014) and in levels of IgM antibodies in aqueous humor (p=0.013) between glaucoma and non glaucoma patients[23].

Another similar prospective study conducted in Turkey included 15 patients with Primary open angle glaucoma , 17 patients with pseudoexfoliation syndrome,19 patients with pseudoexfoliative glaucoma ,and 19 healthy controls. Antiphospholipid antibodies were measured by ELISA assay. Lupus anticoagulant antibodies were measured by using dilute russel viper venom time screen test. It was found that the anticardiolipin antibody IgG levels were significantly higher in patients with PXS,PXG than in POAG and controls ($p < 0.007$). However acl IgM levels in PXS, PXG and POAG was higher but was not statistically significant. The p values were 0.160, 0.106, 0.747 and 0.610 respectively. Lupus anticoagulant antibody levels of pseudoexfoliation patients and controls were not statistically significant[5].

From this study they concluded that elevated levels of serum anticardiolipin antibodies is a risk factor for cardiovascular and cerebrovascular disease in patients with pseudoexfoliation syndrome and pseudoexfoliative glaucoma compared to controls and POAG. The known pathophysiological role of anticardiolipin in pseudoexfoliative patients are oxidative stress, apoptosis, endothelial dysfunction and platelet activation[5] .

The present study included 30 patients with pseudoexfoliation and 30 healthy age matched controls. Echocardiography was performed. All the patients had normal left ventricular diastole. Antiphospholipid antibody were measured by ELISA method in both study and control groups.

The mean anticardiolipin antibody IgG levels in patients with PEX was significantly higher than in control groups (p value<0.05) and the mean value of anticardiolipin antibody IgM was also significantly different between cases and controls (p value<0.01). Both IgG and IgM levels were higher in pseudoexfoliation than in controls.

Although echocardiography showed normal left ventricular function in all patients with pseudoexfoliation, anticardiolipin antibody IgG and IgM was found higher in 10 out of 30 patients with pseudoexfoliation. These patients can go for cardiovascular risk later in their life, due to probable adverse effects of elevated anticardiolipin antibodies on the endothelium.

In our study, we could not find any ocular associations and anticardiolipin antibody.

Conclusion

1)This study concluded that elevated levels of anticardiolipin antibody in patients with pseudoexfoliation.

2)Endothelial dysfunction has an important contributory role in pseudoexfoliation and increased anticardiolipin antibodies, with thrombosis due to endothelial dysfunction being the causative factor for adverse cardiovascular events in patients with pseudoexfoliation.

3) Anticardiolipin antibodies may be an independent factor to evaluate the risk of cardiovascular diseases in pseudoexfoliation .

4) Hence the attending ophthalmologist will be able to intimate the attending physician about the possible cardiac risk association.

5) Further larger scale studies are needed to elucidate the role of elevated anticardiolipin antibodies in pseudoexfoliation.

Limitations:

- This study was performed in a small number of patients.
- We did not get any patients with pseudoexfoliative glaucoma during this period of the study.
- Anticardiolipin antibodies has to be done in two occasions to confirm the diagnosis
- Our results should be confirmed by large studies.

SUMMARY

INTRODUCTION:

Pseudoexfoliation is characterised by the widespread deposition of whitish flaky material adherent to ocular and extraocular tissues. Among extraocular tissue pseudoexfoliative fibres are seen in heart, lungs, skin, gallbladder, bloodvessles. In present years pseudoexfoliation has been shown to be a systemic process associated with cardiovascular disease.

AIMS AND OBJECTIVES:

PRIMARY AIM:

1) To evaluate the levels of anticardiolipin antibodies in patients with pseudoexfoliation and controls.

2) To assess the association between pseudoexfoliation and cardiovascular disease.

Secondary Objective

1) To study the ocular diseases associated with pseudoexfoliation.

2) To correlate between ocular diseases and anticardiolipin antibody.

MATERIAL AND METHODS: This is a prospective study to evaluate the levels of anticardiolipin antibody in patients with pseudoexfoliation. This study included 30 patients with pseudoexfoliation and 30 healthly controls with comparable age and gender with no comorbities.

All patients underwent a complete ophthalmic examination , after PXS was diagnosed**.** Echocardiography was done to know the cardiovascular status of the patients in 2 groups.

Serum anticardiolipin antibodies IgG and IgM was done by using ELISA method in both cases and control groups.

Observations:

We found elevated serum levels of anticardiolipin (IgG and IgM) antibody in patients with pseudoexfoliation. The mean level of acl IgG and IgM level in patients with pseudoexfoliation were statistically significant.

Conclusions:

Elevated levels of anticardiolipin antibody is a risk factor for cardiovascular problems . Hence the attending ophthalmologist will be able to intimate the attending physician about the possible cardiac risk association

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CASE SHEET 1:

Name: Mr.Murugesan

Age: 68

Sex: Male

Address:

Presenting complaints: C/O defective vision in the left eye for past 6months

H/o Presenting illness: Defective vision in left eye ,progressive in nature

Past History:

1)Diabetes Mellitus: NOT A K/C/O diabetic

2)Hypertension: not a k/c/o Hypertensive

3)long term use of drugs: NIL

Systemic Examination:

Blood pressure- 110/80 mmHg

Blood sugar: 98 g/dl

Ocular Examination:

- Visual acuity-

*Best corrected- RE-6/18 LE-PL+

*Near Vision- N36

- Eyelids and adnexa- NORMAL
- Conjunctiva-CLEAR
- Cornea-CLEAR
- Anterior Chamber- NORMAL IN DEPTH
- Iris-COLOR AND PATTERN NORMAL
- Pupil-3 MM REACTING TO LIGHT
- Lens-RE-NS4

LE-MATURE CATARACT

- Extraocular movements-FULL
- Posterior segment examination

*Ophthalmoscopy- RE-DISC AND VESSELS NORMAL

MACULA- NORMAL

- Central Corneal Thickness: RE-515

LE-518

- Slit lamp examination:

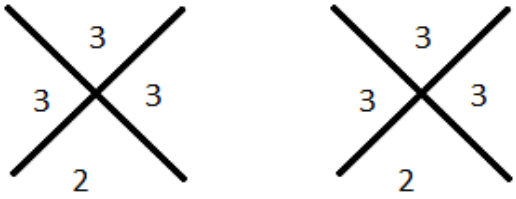
PSEUDOEXFOLIATION IN THE PUPILLARY BORDER IN

BOTH EYES

- Applanation tonometry:RE-14

LE-12

- GONIOSCOPY:RE LE



- <u>Investigations:</u>

<u>A) ECHO-</u> NORMAL LV FUNCTION.

<u>B) Anticardiolipin antibody:</u>

Ig G -12.9**GPL/Ml**

Ig M-2.9**GPL/Ml**

CASE SHEET 2:

Name: MRS- THULASIAMMAL

Age: 62

Sex: FEMALE

Address:

Presenting complaints: C/O defective vision in the both eyes for past 1 year

c/o watering in the both eyes

H/o Presenting illness: Defective vision in both eyes ,progressive in nature

Past History:

1)Diabetes Mellitus: NOT A K/C/O diabetic

2)Hypertension: not a k/c/o Hypertensive

3)long term use of drugs: NIL

Systemic Examination:

Blood pressure- 120/80 mmHg

Blood sugar: 110 g/dl

Ocular Examination:

Visual acuity-

*Best corrected- RE-HM

LE-1/60

*Near Vision- N36

Eyelids and adnexa- NORMAL

Conjunctiva-CLEAR

Cornea-CLEAR

Anterior Chamber- NORMAL IN DEPTH

Iris-COLOR AND PATTERN NORMAL

Pupil-3 MM REACTING TO LIGHT

Lens-RE- MATURE CATRACT

LE- IMMATURE CATARACT,NS4

Extraocular movements-FULL

Posterior segment examination

*Ophthalmoscopy- RE- media was hazy due to catarct

LE- DISC AND VESSELS NORMAL

MACULA- DRUSEN +

CENTRAL CORNEALTHICKNESS:

RE-510

LE-512

Slit lamp examination:

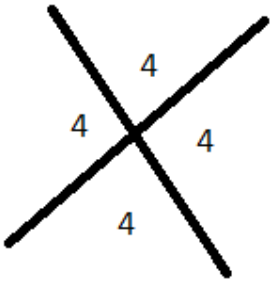
PSEUDOEXFOLIATION IN THE ANTERIOR SURFACE OF THE LENS AND IN PUPILLARY BORDER IN RIGHT EYE

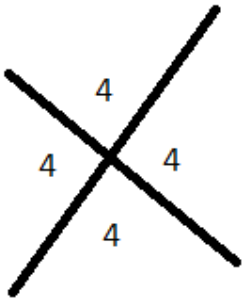
Applanation tonometry:

RE-15

LE-12

GONIOSCOPY:RE LE





Investigations:

A) ECHO- NORMAL LV FUNCTION.

B) Anticardiolipin antibody:

Ig G -12.9**GPL/Ml**

Ig M-10.2**GPL/Ml**5

CASE SHEET 3:

Name: MR KARUPPAN

Age: 59

Sex: MALE

Address:

Presenting complaints: C/O defective vision in the both eyes for past 6 months

H/o Presenting illness: Defective vision in both eyes ,progressive in nature

c/o itching in right eye

Past History:

1)Diabetes Mellitus: NOT A K/C/O diabetic

2)Hypertension: not a k/c/o Hypertensive

3)long term use of drugs: NIL

Systemic Examination:

Blood pressure- 120/90 mmHg

Blood sugar: 116 g/dl

Ocular Examination:

Visual acuity-

*Best corrected- RE-1/60

LE-1/60

*Near Vision- N60

Eyelids and adnexa- NORMAL

Conjunctiva-CLEAR

Cornea-CLEAR

Anterior Chamber- NORMAL IN DEPTH

Iris-COLOR AND PATTERN NORMAL

Pupil-4 MM ROUND REACTING TO LIGHT

Lens-RE- IMMATURE CATRACT,NS4

LE- IMMATURE CATARACT,NS4

Extraocular movements-FULL

Posterior segment examination

*Ophthalmoscopy- RE- media was hazy due to catarct

BE- DISC NORMAL

CENTRAL CORNEALTHICKNESS:

RE-512

LE-511

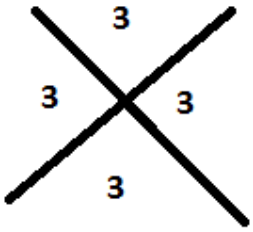
Slit lamp examination:

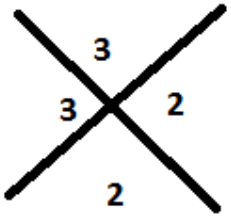
PSEUDOEXFOLIATION IN THE ANTERIOR SURFACE OF THE LENS AND IN PUPILLARY BORDER IN RIGHT EYE

Applanation tonometry:RE-10

LE-12

GONIOSCOPY:RE LE





TRABECULAR PIGMENTATION DARK IN RIGHT EYE

Investigations:

A) ECHO- NORMAL

B) Anticardiolipin antibody:

Ig G -12.**GPL/Ml**

Ig M- 2.0**GPL/Ml**

CASE SHEET 4:

Name: MRS.KALIYAMMAL

Age: 55

Sex: FEMALE

Address:

Presenting complaints: C/O defective vision in the both eyes for past 6 months

H/o Presenting illness: Defective vision in both eyes ,progressive in nature

Past History:

1)Diabetes Mellitus: NOT A K/C/O diabetic

2)Hypertension: not a k/c/o Hypertensive

3)long term use of drugs: NIL

Systemic Examination:

Blood pressure- 130/90 mmHg

Blood sugar: 120 g/dl

Ocular Examination:

Visual acuity-

*Best corrected- RE- CFCF

LE-6/24

*Near Vision- N60

Eyelids and adnexa- NORMAL

Conjunctiva-CLEAR

Cornea-CLEAR, NEBULLA +

Anterior Chamber- NORMAL IN DEPTH

Iris-COLOR AND PATTERN NORMAL

Pupil-3 MM ROUND REACTING TO LIGHT

Lens-RE- MATURE CATRACT

LE- IMMATURE CATARACT,NS2

Extraocular movements-FULL

Posterior segment examination

*Ophthalmoscopy- RE- media was hazy due to catarct

LE- DISC AND VESSELS NORMAL

MACULA -FOVEAL REFLEX +

CENTRAL CORNEALTHICKNESS:

RE-498

LE-493

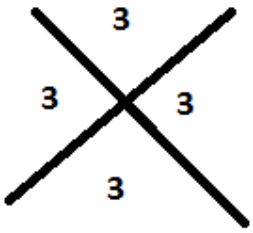
Slit lamp examination:

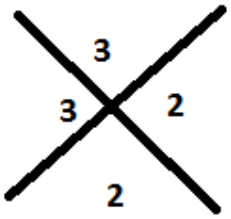
PSEUDOEXFOLIATION IN THE ANTERIOR SURFACE OF THE LENS IN BOTH EYES

Applanation tonometry:RE-17

LE-17

GONIOSCOPY:RE LE





Investigations:

A) ECHO- NORMAL

B) Anticardiolipin antibody:

Ig G -12.1**GPL/Ml**

Ig M- 2.0**GPL/ML**

MASTER CHART

NAME OP NUMBER	AGE SEX	VISUAL ACUITY		CATARACT		PXF ZONES		ANGLES		GONIOSCOPY TRABECULAR PIGMENTATION		INTRA OCULAR PRESSURE		CENTRAL CORNEAL THICKNESS		APLA	
1.MURUGASEN O12/044170	68/M	6/18	PL	NS4	MC	IRIS	IRIS	OPEN	OPEN	DARK	DARK	14	12	515	518	12.9	2.9
2.THULASIAMMAL O11090323	62/F	6/9	6/36	PCIOL	NS3		LENS	OPEN	OPEN	N	N	10	8	507	498	2.9	3.0
3.THIRUGNANAM O12058266	85/M	6/24	6/36	NS3	NS3	IRIS	IRIS	OPEN	OPEN	DARK	DARK	18	16	607	620	5.1	4.3
4.ARUNACHALAM O12054608	64/M	6/12	6/18	PCIOL	NS2	IRIS	IRIS	OPEN	OPEN	DARK	DARK	16	16	473	478	1.7	4.3
5.RAMAL O12062085	80/F	HM	I/60	MC	NS4	IRIS LENS		OPEN	OPEN	DARK		15	12	510	512	12.9	10.2
6.RAMASAMY O12062081	60/M	1/60	6/60	NS4	NS3	LENS	LENS	OPEN	OPEN	N	N	12	10	493	495	2.4	3.8
7.THIRUVENKATASAMY O12032031	68/M	6/36	6/24	NS3	NS3	IRIS	IRIS	OPEN	OPEN	DARK	DARK	18	18	496	510	9.3	4.5
8.DEVARAJAN O12065085	60/M	CFCF	6/18	MC	PCIOL		LENS	OPEN	OPEN		DARK	15	11	505	508	6.2	2.1
9.KARUPPAN O00009760	59/M	1/60	1/60	NS4	NS4	IRIS LENS		OPEN	OPEN	DARK		10	12	512	511	12.0	2.0
10.ANANDHALAKSHMI O12070286	88/F	HM	6/60	MC	NS3	IRIS	IRIS	OPEN	OPEN	DARK	DARK	18	16	523	524	3.4	3.4
11.VALLIAMMAL O12070284	65/F	6/18	3/60	PCIOL	NS4		LENS	OPEN	OPEN	N	N	12	11	515	512	2.8	2.8
12.RAJAMMAL O12070645	68/F	6/60	6/36	PCIOL	NS3		LENS	OPEN	OPEN	DARK	DARK	12	12	498	493	4.1	2.2
13.KANTHATHAL O12072629	55/F	6/60	6/18	NS3	NS3	IRIS		OPEN	OPEN	DARK		18	10	510	512	4.3	5.5
14.DHANDAPANI	61/M	4/60	4/60	NS4	NS4		IRIS	OEN	OPEN		DARK	10	10	513	518	11.0	7.9

NAMES	AGE SEX	VISUAL ACUITY		CATARACT		PXF ZONES		ANGLES		GONIOSCOPY TRABECULAR PIGMENTATION		INTRA OCULAR PRESSURE		CENTRAL CORNEAL THICKNESS		APLA	
15.SUNDARAM O12075491	64/m	6/12	6/12	Ns2	Ns2	Iris	Iris	Dark	Dark	Open	Open	14	14	495	501	6.6	6.0
16.KALIYAMMAL O12083994	55/F	CFCF	6/24	MC	NS2	LENS	LENS	N	N	OPEN	OPEN	17	17	498	493	12.1	2.0
17.SUSEELA O12084258	55/F	6/36P	6/36	PSC	PSC	IRIS	IRIS	DARK	DARK	OPEN	OPEN	17	16	495	501	3.0	2.3
18.NAGAMMAL O13012492	60/F	PL+	6/6	MC	PCIOL	IRIS LENS	-	DARK		OPEN	OPEN	12	14	481	483	12.9	2.9
19.MARY O13013726	70/F	6/12	6/18P	NS2	NS2	IRIS	-	-	-	OPEN	OPEN	12	16	495	501	6.1	5.3
20.AMARAVATHY O13013514	69/F	6/24	6/9	NS2	PCIOL	IRIS		-	-	OPEN	OPEN	11	10	511	519	12.3	9.0
21.KOMARASAMY O11088348	71/M	6/36P	3/60	PCIOL	NS4	LENS	-	DARK	DARK	OPEN	OPEN	10	12	505	509	12	12
22.MAYILSAMY I13012663	60/M	6/12	2/60	PCIOL	NS4	IRIS	IRIS	DARK	DARK	OPEN	OPEN	17	16	510	512	3.2	9.0
23.KANNAMMAL I13017198	70/M	HM	6/60	MC	NS3	IRIS	IRIS	DARK	DARK	OPEN	OPEN	10	12	499	503	4.9	5.0
24.GOPALAN O13041753	70/M	6/12	6/9	PCIOL	PCIOL	IRIS	-	N	N	OPEN	OPEN	12	14	512	514	12	12
25.PRABUKARAN O13044610	60/M	6/9	6/9	NS1	NS1	IRIS	IRIS	DARK	DARK	OPEN	OPEN	15	15	502	504	6.0	6.6
26.SUNDARI O03022514	59/F	6/24	6/24	PCIOL	PCIOL	IRIS	-	N	N	OPEN	OPEN	13	12	555	555	4.5	9.3
27.VALIAMMAL	60/F	6/36	6/24	PCIOL	PCIOL	IRIS	IRIS	DARK	DARK	OPEN	OPEN	12	12	514	515	12.9	10.2
28.BALAKRISHNAN O13000838	62/M	6/24	6/9	NS2	PCIOL	LENS		N	N	OPEN	OPEN	10	11	540	556	12.9	2.9
29.BALASUBRAMANIAN O12076377	62/M	6/18	6/18	PCIOL	PCIOL	IRIS	IRIS	DARK	DARK	OPEN	OPEN	14	14	540	555	4.1	2.2
30.LAKSHMIIAMMAL O09040037	56/F	6/60	6/60	NS2	NS2	LENS	LENS	DARK	DARK	OPEN	OPEN	17	16	560	555	2.8	2.8