A Dissertation on

ANALYTICAL STUDY ON EPIDEMIOLOGY OF PTERYGIUM

IN A TERTIARY CARE CENTRE

Dissertation submitted for

M.S.Degree in Ophthalmology

MAY 2018

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I solemnly declare that this dissertation entitled "**ANALYTICAL STUDY ON EPIDEMIOLOGY OF PTERYGIUM IN A TERTIARY CARE CENTRE**" is a bonafide and genuine research work done by me under the supervision and guidance of **Dr. M. Hemanandini M.S., D.O.,** Professor of the Department of Ophthalmology, Coimbatore Medical College, Coimbatore.

This is submitted to The **Tamil Nadu Dr. M.G.R Medical University**, Chennai in partial fulfillment of regulations required for the M.S. Ophthalmology, Branch III Degree Examination to be held in **MAY 2018**.

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This is to certify that the dissertation entitled "**ANALYTICAL STUDY ON EPIDEMIOLOGY OF PTERYGIUM IN A TERTIARY CARE CENTRE**" is a bonafide research work done by **Dr. Swetha. K**, Postgraduate in M.S. Ophthalmology, Coimbatore Medical College, Coimbatore under my direct guidance and supervision, to my satisfaction, in partial fulfillment of the regulations required for the award of M.S Degree in Ophthalmology(Branch III).

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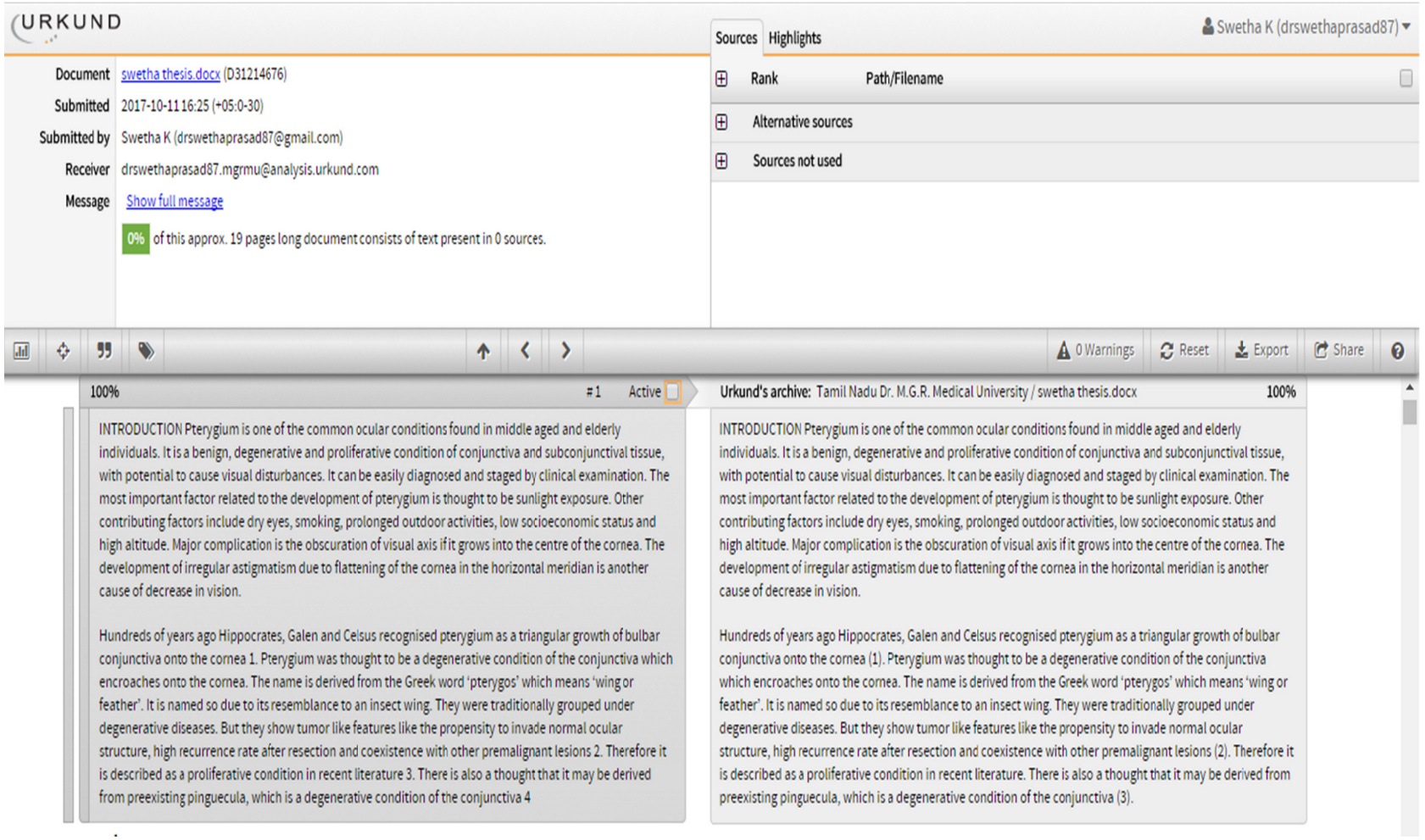
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INTRODUCTION Pterygium is one of the common ocular conditions found in middle aged and elderly individuals. It is a benign, degenerative and proliferative condition of conjunctiva and subconjunctival tissue, with potential to cause visual disturbances. It can be easily diagnosed and staged by clinical examination. The most important factor related to the development of pterygium is thought to be sunlight exposure. Other contributing factors include dry eyes, smoking, prolonged outdoor activities, low socioeconomic status and high altitude. Major complication is the obscuration of visual axis if it grows into the centre of the cornea. The development of irregular astigmatism due to flattening of the cornea in the horizontal meridian is another cause of decrease in vision.
Hundreds of years ago Hippocrates, Galen and Celsus recognised pterygium as a triangular growth of bulbar conjunctiva onto the cornea 1. Pterygium was thought to be a degenerative condition of the conjunctiva which encroaches onto the cornea. The name is derived from the Greek word 'pterygos' which means 'wing or feather'. It is named so due to its resemblance to an insect wing. They were traditionally grouped under degenerative diseases. But they show tumor like features like the propensity to invade normal ocular structure, high recurrence rate after resection and coexistence with other premalignant lesions 2. Therefore it is described as a proliferative condition in recent literature 3. There is also a thought that it may be derived from preexisting pinguecula, which is a degenerative condition of the conjunctiva 4
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ABBREVIATIONS & ACRONYMS

UV	-	Ultraviolet
HT	-	Hypertension
DM	-	Diabetes mellitus
TBUT	-	Tear film Break Up Time
VEGF	-	Vascular Endothelial Growth factor
ICAM	-	Intercellular Adhesion Molecule 1
HLA	-	Human Leukocyte Antigen
MMC	-	Mitomycin C
5FU	-	5 flouro uracil

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INTRODUCTION

Pterygium is one of the common ocular conditions found in middle aged and elderly individuals. It is a benign, degenerative and proliferative condition of conjunctiva and subconjunctival tissue, with potential to cause visual disturbances. It can be easily diagnosed and staged by clinical examination. The most important factor related to the development of pterygium is thought to be sunlight exposure. Other contributing factors include dry eyes, smoking, prolonged outdoor activities, low socioeconomic status and high altitude. Major complication is the obscuration of visual axis if it grows into the centre of the cornea. The development of irregular astigmatism due to flattening of the cornea in the horizontal meridian is another cause of decrease in vision.

Hundreds of years ago Hippocrates, Galen and Celsus recognised pterygium as a triangular growth of bulbar conjunctiva onto the cornea[1]. Pterygium was thought to be a degenerative condition of the conjunctiva which encroaches onto the cornea. The name is derived from the Greek word ‘pterygos’ which means ‘wing or feather’. It is named so due to its resemblance to an insect wing. They were traditionally grouped under degenerative diseases. But they show tumor like features like the propensity to invade normal ocular structure, high recurrence rate after

resection and coexistence with other premalignant lesions[2]. Therefore it is described as a proliferative condition in recent literature[3]. There is also a thought that it may be derived from preexisting pinguecula, which is a degenerative condition of the conjunctiva[4] or from conjunctivochalasis which is a dry eye related condition[5].

Pterygium is one of the very commonly encountered ocular condition in our country, which belongs to the "pterygium belt" described by Cameron[6]. It amounts to significant visual morbidity of our population. Proper understanding of the epidemiology and risk factors of this condition is essential for planning appropriate measures to prevent its occurrence and thereby reducing the physical and financial burden to the society.

Epidemiology

Even though the pterygium has a worldwide distribution it is seen most commonly in tropical and subtropical areas with warm and dry climate [6]. Hot, dry, dusty, windy areas have higher prevalence. The approximate global prevalence of pterygium varied from 2.8 to 33% in various studies[7,8]. Prevalence drops in areas more than 37 degree of latitude[6]. The prevalence is found to be low (2%) in regions above 40 degrees and is high in equatorial regions (22%)[9,10].The prevalence of pterygium could not be detected accurately in previous studies since it

has some geographical distribution and there are no exact population based studies. In Indian studies prevalence was found to be 11.7 % in a study in Andrapradesh[11] and 9.5 % in a study in Tamilnadu[12].

Risk factors

Although the exact cause of the development of pterygium is not well understood the exposure to ultraviolet light seems to be the most accepted risk factor(5). Dry eyes may also contribute to the development.

Age group

Pterygium is common in elderly individuals. It affects the people of age group 20 and above[6]. It is seen that the prevalence increases with the increasing age. The cumulative effect of the risk factors is responsible for this. It is also noted that the prevalence of pterygium increases in the age group above 40 but the incidence is more in the age group 20-40. The exact reason for this is still not known.

Sex

There is no general sexual predilection in disease occurrence. Some studies showed male preponderance[1314] but others showed female[15]. Male preponderance shown in most of the studies, might be due to the fact that males were involved in the outdoor work, more often than women[16].

Heredity

Pterygium is inherited in a dominant fashion with low penetrance. The way an eye reacts to the environmental factors is what is getting transmitted (6). Few studies have shown that pterygium is associated with positive family history[17].

Ultraviolet light exposure

The ultraviolet (UV) light is made of 3 types of rays; UV A (400-320 nm) responsible for tanning, UV B (320-290 nm) responsible for sunburn and skin cancer and UV C (290-100 nm) which do not reach the earth surface. The depletion of ozone layer in the recent years has caused more amounts of UV rays to reach the earth, thereby increasing the incidence of pterygium. Pterygium was seen to be more common in regions around the equator, between the latitude 37 degree north and south[6]. It was found to be seen more commonly in people working outdoors who were more exposed to UV light than who worked indoors[10]. Also, the risk was increased among people working outdoors with highly reflectance surfaces. Fresh snow reflects maximum of the UV light followed by sand and concrete pavement[9].

The systemic associations of pterygium further pointed out UV light as the common risk factor. It was seen associated with basal cell carcinoma, xeroderma pigmentosa, porphyria cutanea tarda[18],

hyperkeratosis, cutaneous melanoma[19]. The patients with pterygium also had cataract which was also linked to UV light[20].

Occupation

Some kind of occupations increases the risk of developing pterygium. The people with outdoor occupation and spending more time in sun had more risk. It was also found to be more in welders who were exposed to harmful UV rays [21,22] The prevalence also increased in saw mill workers, labourers, fishermen, station hands and stockmen.

Tear film abnormalities

Association of pterygium with dry eye was also documented. Local drying due to tear film abnormalities or high humidity with constant wind was found to be the risk factors. It was also proposed that the ultraviolet light causes rapid evaporation of tear film and tear film dysfunction causing dry eye [23]. Drying of the medial third of the palpebral fissure occurred when there was constant wind which also accounted for the more common nasal pterygium.

Few other studies compared the effect of mucin deficiencies in pterygium. They found that, there was marked decrease in tear film break up time (TBUT) in pterygium patients when compared to the controls [24].

Smoking and alcohol intake

Cigarette smoking and alcohol increases the risk of developing pterygium[25]. Smoking induces an inflammatory reaction in the cornea which might be the trigger. There are few other studies which show that the incidence of pterygium is less in smokers[26]. So smoking is not a well documented risk factor.

Effect of high altitude

The people living in high altitude develop pterygium more frequently than those at lower altitudes[27]. Several physiological and pathological changes occur in the eye at high altitude. The ultraviolet radiation exposure is also higher at higher altitude. The prevalence of dry eye is also more in high altitudes adding to the risk factors[28].

Socio economic status

People of low socio economic status are more prone to develop pterygium, since they more often engage in outdoor works[29]. Lack of knowledge and availability of protective sunglasses and hats make them more vulnerable[11].

Lack of protective glasses

The sun glasses, hats and proper sheltering prevent some amount of UV light from entering the eyes[15,30].

Bilateral involvement

Pterygium is usually a bilateral condition. But it is seen that one eye follows the next (sequential bilaterality). Bilateral involvement was documented in one third of cases. It was also seen in few studies that the bilateral cases had more sun exposure in their early lives compared to the unilateral cases[31].

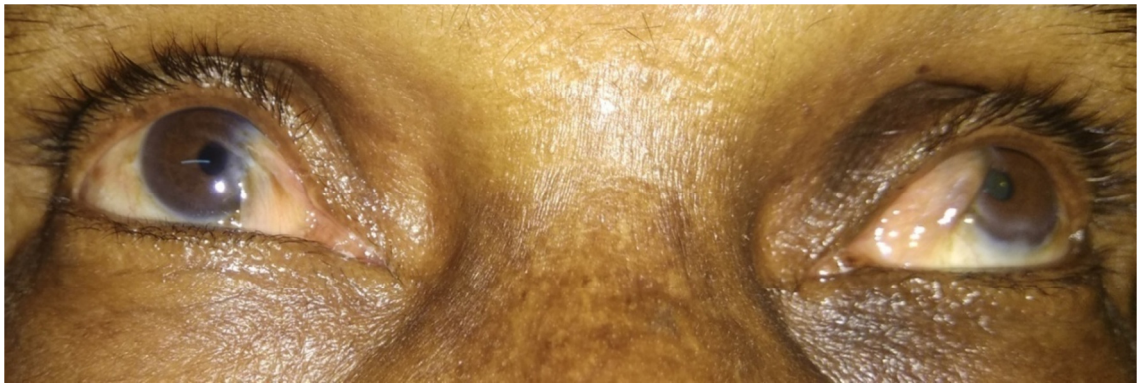


Figure 1: bilateral pterygium (nasal)

Pinguecula

It is well accepted that pinguecula and primary pterygium are related to one another. But pinguecula do not precede the recurrent pterygium. According to Zehender pterygium is the encroachment of pinguecula onto the cornea[1]. It is proposed that the degeneration causes

the elastic tissue to undergo hypertrophy and hyperplasia and deposition of hyaline material which will causes changes in the limbus by elevating it and incite the formation of the pterygium. The histopathology of pterygium and pinguecula had so many similarities except for the corneal changes[4]. So it was thought to be a precursor of pterygium which develops when there is a break in the limbal barrier[4].

Relevant anatomy related to the pterygium

Anatomically the structures involved in the formation of pterygium are conjunctiva, limbus and the cornea

Conjunctiva

It is a mucous membrane of the eye which lines the anterior part of eyeball and inner aspect of the lids. It can be divided into the palpebral part and the bulbar part which are connected to each other by the cul de sac, the fornix. The layers of conjunctiva histologically are the epithelium, adenoid layer and the fibrous layer. It consists of the mucin glands and the accessory lacrimal glands which are the glands of Krause, Wolfring and the rudimentary accessory lacrimal glands.

The tarsal conjunctiva is firmly adherent to the tarsus. The bulbar conjunctiva is loosely attached to the underlying tenons capsule. At the surgical limbus it will fuse with the tenons layer and the underlying

episcleral tissue. The substantia propria of the conjunctiva stops here and the epithelium continues as the epithelium of the cornea. The epithelium at the limbus will be several layers thick and irregularly arranged. The episcleral plexus of vessels are situated at the limbus. The conjunctival stroma, the limbal stroma and the bowmans layer of the cornea are in the same plane. Conjunctival stroma consists of fibroblasts, blood vessels and inflammatory cells.

Limbus

Anatomically the transitional zone between cornea and the conjunctiva and sclera is the limbus. The area is bounded anteriorly by a line joining the termination of bowmans and descemets membrane. The posterior aspect is the line joining scleral spur to a point perpendicular to the surface of cornea. This zone has important functions. The basal cells of the epithelium in this zone are regarded as the stem cells and the vascular loops in its stroma provide nourishment to the avascular cornea. The loss of the limbal cells in conditions like aniridia, inflammations and injuries to the ocular surface like the chemical burns is responsible for the loss of renewable source of corneal epithelial cells.

Limbal epithelium

It is similar to the corneal epithelium except for the fact that it has more melanocytes and langerhan cells. The basal cells of limbal epithelium are much smaller and less columnar than corneal and they have firm adhesions to the underlying stroma with undulating extensions. They have more number of mitochondria. They form the stem cells of the corneal epithelium. They have the property of unlimited self renewal. Only 5 to 15% of limbal cells are stem cells [32]. They have a centripetal migration.

Connective tissue of the limbus is loosely and irregularly arranged. Capillaries, venules and small arterioles are present in this layer. The corneal epithelium continues as the conjunctival epithelium. The epithelium at the limbus is thrown into folds which are arranged radially. These are known as the palisades of Vogt. These are the folds which will lodge the basal cells .The blood vessels, lymphatics and nerves are present in the connective tissue within the folds. The lamina propria of the conjunctiva and the tenons capsule is the continuation of the bowmans membrane. Descemets membrane terminates at the schwalbes line. Endothelium continues as the endothelium of the trabecular meshwork.

Blood supply of limbus is by anterior conjunctival artery which is a branch of the anterior cilary artery.

Cornea

It is a transparent structure which forms the anterior 1/6th of the outer fibrous coat of the eyeball. Surface is elliptical with horizontal diameter of 11- 12 mm and vertical diameter of 10-11mm[1]. Cornea has a refractive power of 1.376. Thickness in the centre is 0.52 and the periphery is 0.67 mm. The radius of curvature of anterior surface of cornea is 7.7 mm and posterior surface is 6.9 mm and a refractive power of 43 dioptres[32].

Cornea is made up of 5 layers: Epithelium, Bowman's membrane, Stroma or the substantia propria, Descemet's membrane and the endothelium from anterior aspect to posterior.

Cornea is an avascular structure and do not have any lymphatic drainage. Small loops from the anterior ciliary vessels invade 1mm of the periphery[32]. These are in the overlapping subconjunctival tissue. It is richly supplied by nerve from the long ciliary nerves which makes plexus within cornea.

Corneal transparency

The transparency of the cornea is due to the avascular nature of the cornea and the regular arrangements of the corneal lamellae as well as due to an efficient endothelial pump mechanism.

Histology & Pathogenesis

Histologically pterygium contains area of varying thickness of limbal epithelium and bulbar conjunctiva which is made up of amorphous, eosinophilic material with a granular appearance[23]. It is covered by conjunctival epithelium. The subepithelial tissue resembles an elastic tissue which is actually abnormal collagen fibres which take the appearance of a coiled and fibrillated pattern[32]. It is not true elastic tissue since it is not digested by elastase. It is the effect of elastoid and elastotic degeneration of the collagen and fibrovascular proliferation. There is an increase in the stromal fibroblasts and a minor aggregation of mucopolysaccharides and other proteinaceous substances. The epithelium over it can be either atrophic, hyperplastic or even normal[23].

It was noticed with ultrastructural studies that the elastotic material came from degenerated collagen, preexisting elastic fibres, abnormal fibroblast activity and abnormal ground substance[33]. Dermis of the skin in the sun exposed individuals showed similar histological features.

Pathogenesis

Pterygium is a fibro vascular lesion with cellular proliferation, tissue remodeling and neovascularisation. There are large numbers of theories explaining the pathogenesis of pterygium, but the exact etiology is yet to be finalized[23]. The most common one is of ultraviolet radiation which showed that the exposure to UV radiation produces reactive oxygen species which may trigger the development of pterygium. There occurs damage to the bowmans membrane and thickening and hyperplasia of the bulbar sub conjunctival connective tissue due to the effect of UV radiation. The defects at the level of Bowmans membrane will be seen as the first clinical change[23]. This damage will trigger the fibroblasts at the limbus for the repair process. The reparative process will cause the deposition of elastotic material. The head of the pterygia grows in a plane which is between the Bowmans membrane and the epithelium. There occur inflammatory reactions. The increased cellular activity will cause ingrowth of blood vessels. The lymphokines released by the lymphocytes promote angiogenesis.

The notable feature of the pterygium is that there is vascularisation in the avascular cornea. Ashton and cook put forward 2 theories to explain the vascularisation[34]. One theory is that cornea produces some substance which will cause the limbal vessels to grow. Second theory is

that normally vascularisation is prevented by some growth inhibiting substance or due to corneal compactness. A breech in any of the two will cause vascularisation.

Fromer and Klintworth showed that there occurred the arrival of leucocytes, macrophages and polymorphs before the vascularisation showing inflammatory nature[35]. Associated edema decreases the compactness which will allow easy penetration by new vessels. There occurs epithelial hyperplasia and fibrovascular growth. The modified limbal cells migrate and enter cornea.

The residual corneal scarring after removal is because of the fact that the bowmans layer is destroyed by the pterygia. Immunohistologic studies showed altered limbal epithelial stems cells at the leading edge. Injury or activation of these stems cells with irradiation caused initiation of pterygium.MMP released by the altered limbal stem cells, may cause tissue remodeling, dissolution of bowmans membrane which is associated with the progression of pterygia.

Inflammation

All the cases of the pterygia presents with chronic inflammatory reaction. There is a difference in the goblet cell density in the pterygium and the rest of the normal conjunctiva[36]. The pterygium epithelium

expresses Intercellular Adhesion Molecule 1 (ICAM 1) and Human Leukocyte Antigen (HLA DR) molecules and mediate the inflammatory reaction. Both the epithelium and stroma show infiltration of CD 4 and CD8 lymphocytes and also immunoglobulins IgG and IgE[37]. This indicates that both humoral and cell mediated immunity may be responsible for the pterygium pathogenesis.

It has also been described that UV radiation can cause mutation in tumor suppressor gene p 53 and cause uncontrolled cell proliferation[38]. There occurs cell proliferation and genomic instability due to loss of its heterozygosity and resultant inactivation [39].

There occurs an immune reaction to vascular endothelial growth factor whose expression is increased in the pterygium tissue and less in normal conjunctival tissue[40]. Pterygium angiogenesis factor was produced due to repeated irritation at limbus which caused the vessel ingrowth. Endothelial progenitor cells and substance P may also be involved in the pathogenesis[41].

Recurrence is more common in young people with pterygium. Recurrent pterygium will have fibrovascular proliferation and no elastotic degeneration.

Lee JK et al showed that endothelial progenitor cells, substance P, vascular endothelial growth factor and stem cell factor are involved in the pathogensis[41].

The body of the pterygium is not attached to the episclera but to the tenons capsule explaining its mobility over the sclera. At the limbus lack of tenons capsule makes it adherent to the episclera. So a probe cannot be passed underneath it at the neck.

Pterygium and astigmatism

Pterygium induces significant changes in the topography of the cornea. There will be flattening in the horizontal meridian. The astigmatism so induced most probably will be with the rule astigmatism[42] or oblique astigmatism. Astigmatism may be either due to the mechanical traction on the cornea or due to the pooling of tears on the advancing edge of the pterygium[43]. A significant correlation between the corneal astigmatism and the size of pterygium was found in a previous study[44]. They found out that if the growth exceeded more than 45 % of the radius a significant degree of astigmatism was induced[44]. The amount of astigmatism was found to be proportionate to the length, depth and width of the pterygium which determines the pulling force[45]. The accurate measurement of this astigmatism is possible with the help of videoeratography and not with routine refraction or keratometry [46]. The

astigmatism developed due to pterygium was significantly reduced after its excision[43,44].

Classification of pterygium

Pterygium is a raised triangular shaped lesion of the cornea. Base is on the paralimbal conjunctiva, apex towards the centre of the cornea.

Anatomically it can be divided into the following parts

- Fuchs patches- gray patches seen near the head
- Stockers line- iron deposits seen as a brownish line due to chronic pooling of the tears anterior to the cap.
- Hood- non vascular fibrous portion of pterygium
- Head- highly vascular and raised part of the apex
- Body- elevated fleshy portion with congested tortuous vessels
- Base- paralimbal conjunctiva
- Superior edge- upper edge of traingular flap
- Inferior edge- lower edge of triangular flap

The severity of the pterygium is evaluated based on few observations which include the following

1) Length of encroachment onto the cornea

- Stage 0- pinguecula-posterior to the limbus
- Stage I restricted to the limbus
- Stage II marginally invade the cornea
- Stage III between limbus and pupillary margin
- Stage IV central to the pupillary margin

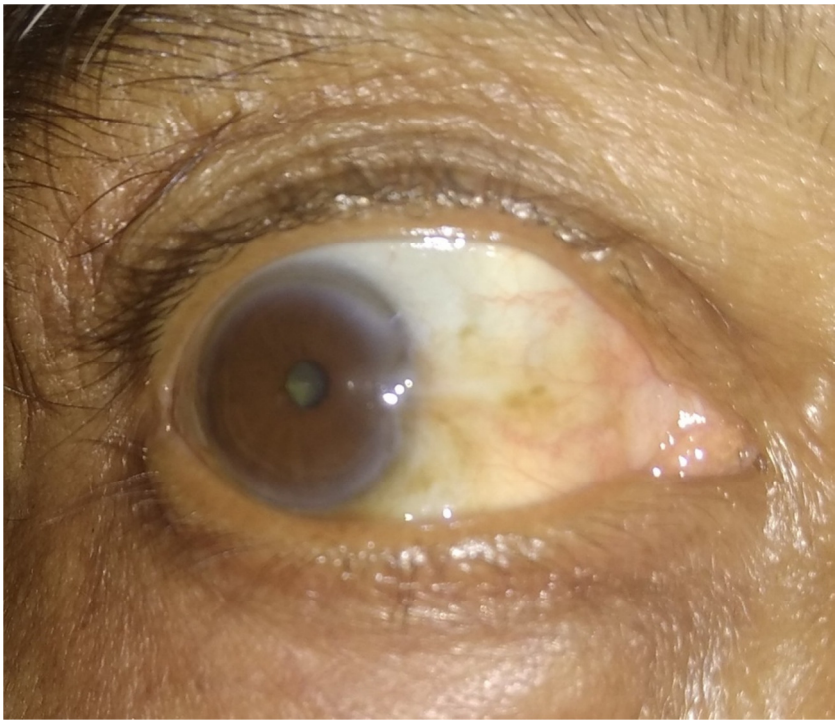


Figure 2 :Stage 1 pterygium

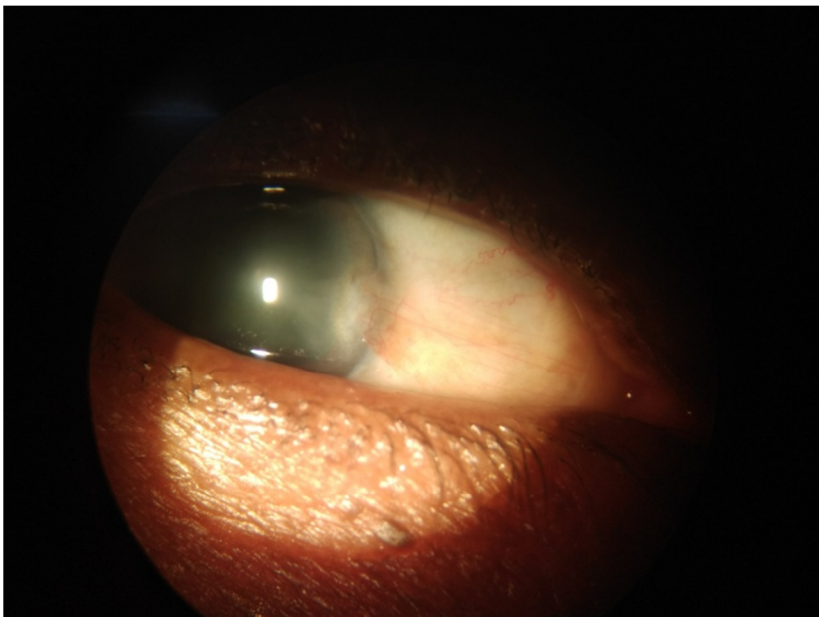


Figure 3: Stage 2 pterygium

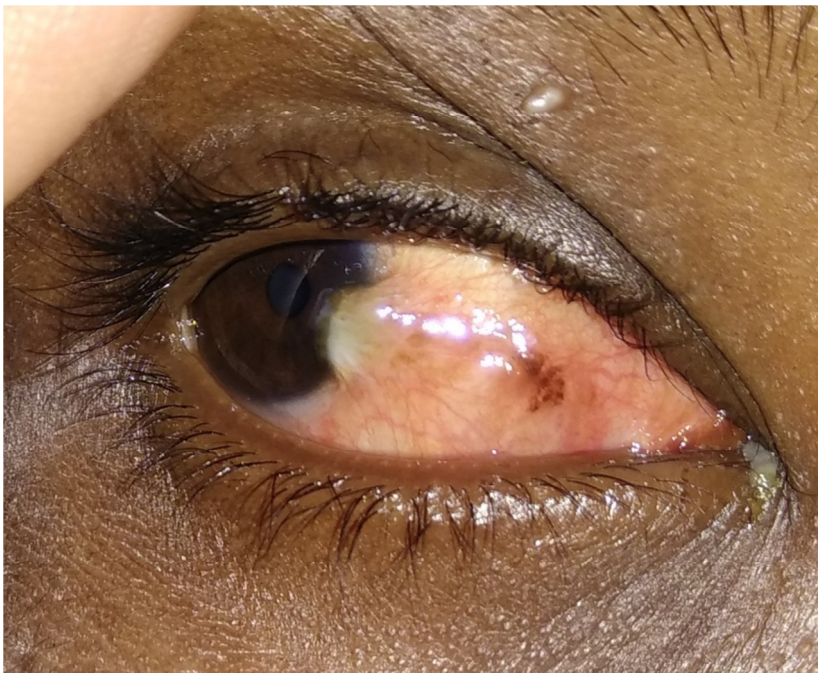


Figure 4: Stage 3 pterygium

The more the pterygium enchroaches on the cornea the more will be the visual symptoms of the patients. It may be because of the induced astigmatism or corneal irregularities or the obscuration of the pupil.

2) The base width of the pterygium- measured with calipers- also important indicator of the severity
3) The translucency of the pterygium tissue- a grading system was developed by Tan and co workers[47]

Increased fleshiness or thickeness of the pterygium causes loss of translucency

- Grade I- atropic pterygium- episcleral vessels are clearly visible
- Grade II intermediate- episcleral vesels are partly visible
- Grade III- fleshy opaque- episcleral vessels are wholly obscured

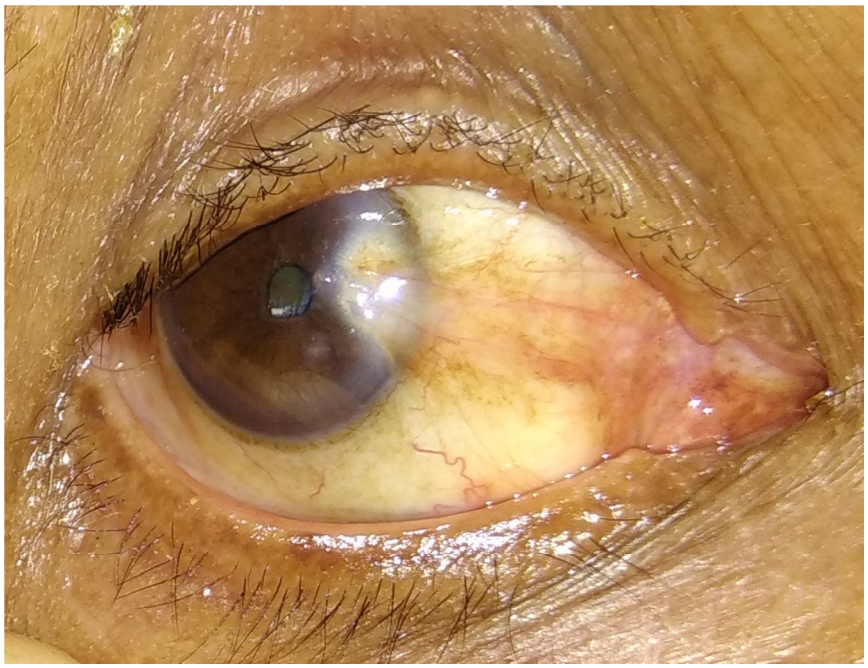


Figure 5 : Regressive / Atrophic pterygium

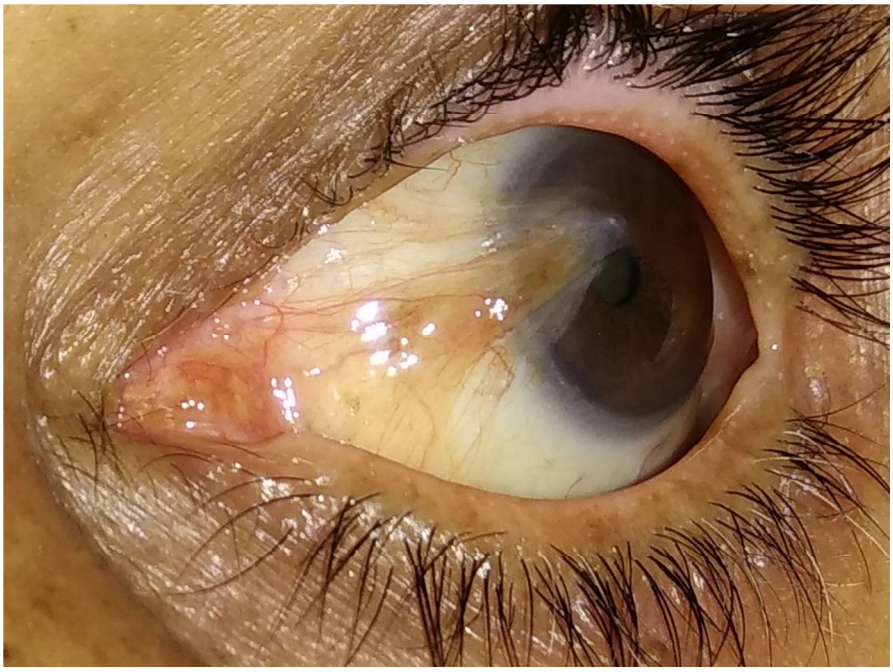


Figure 6 : Intermediate pterygium

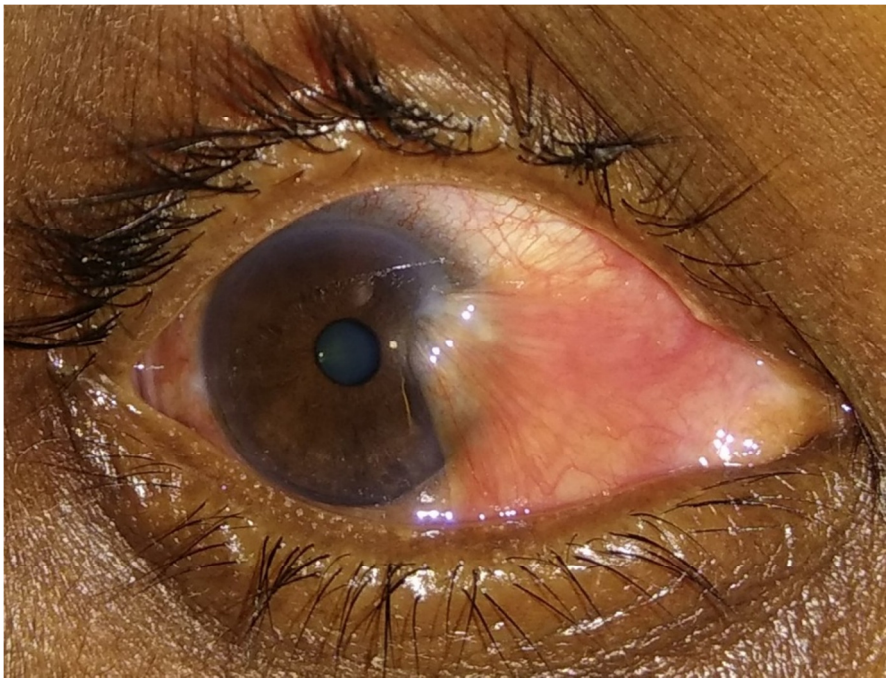


Figure 7: Fleshy Pterygium

Clinical signs

Pterygium is an abnormal fold of membrane in the interpalpebral area strongly attached to its apex and the neck. A probe cannot be passed behind the neck of the pterygium. There is found to be no malignant transformation even though it shows the features of malignancy like local invasion and recurrence. It can present as

- Progressive- it will be thick and fleshy with a cap and marked vasuclarity. It will increase in size and reach the centre or even cross it.
- Stationary pterygium is vascular but its head looks less vascular and it will have a stockers line due to pooling of tears.
- Regressive- it will be thin, grey with poor vascularity and no cap.
- Primary double- both nasal and temporal pterygium present
- Recurrent with more width after the primary excision
- Pseudo pterygium- adhesion of a fold of conjunctiva onto the cornea.
- Malignant pterygium- recurrent pterygium with restriction of movement to the opposite side.

Symptoms

Small pterygium is usually asymptomatic. As they grow the patients can have dry eye symptoms like eye discomfort, foreign body sensation, congestion, irritation and tearing. The dry eye symptoms are due to the irregular wetting of the corneal surface. As it progresses it may be apparent to the naked eye and may cause a cosmetic blemish to the patient. Further growth causes disturbances in visual acuity either due to direct encroachment or due to the induced astigmatism. Patient can also develop binocular diplopia especially in recurrent pterygium when the horizontal movement is restricted due to traction.

Differential diagnosis

The pterygium is not usually confused with other diseases. Some pathology of the limbus and the peripheral cornea can be included as differentials of the pterygium. The conditions are pseudopterygium, pinguecula, limbal dermoid, phlyctenular kerato conjunctivitis,, lymphoma of the conjunctiva, squamous cell carcinoma of th elimbus, nodular episcleritis and bowens disease.

Pseudo pterygium is a fibrovascular scar extending from the conjunctiva to the cornea. It can occur in any corneal zone. It is formed by limbal inflammations or peripheral corneal tear repair. It can occur in

any age group. It is always stationary and a probe can be passed beneath the neck. The limbal inflammation can be caused by chemicals, burns, and microbiological or autoimmune insults.

Pingeucula are small yellow raised nodules on the nasal side of the bulbar conjunctiva. Some authors consider them to be the precursor lesion of perygium.

Limbal dermoid is a benign congenital lesion most frequently seen in the inferotemporal limbus.

Phyctenular keratoconjunctivitis is an inflammatory condition triggered by microbial antigens.

Lymphoma of the conjunctiva are salmon coloured patches seen in the superficial conjunctiva

Squamous cell carcinoma of the limbus develop from the limbal stem cells and are most commonly seen in the nasal or the temporal limbus of elderly individuals. It may have a gelatinous velvet pappilliform appearance.

Nodular episcleritis presents as a freely mobile hard and tender nodule localised to one area of conjunctiva.

Bowens epithelioma is a carcinomatoid lesion at the limbus induced by solar radiation. It is seen as reddish vascularised plaque at limbus.

MANAGEMENT

The definitive treatment of pterygium is surgical excision. But if the condition is in early stages we can manage it conservatively with lubricating eye drops. We have to educate the patients about the risk factors and motivate them to wear protective eye wear and hats. Mild corticosteroid or nonsteroidal eye drops can be given for inflamed pterygium. When the lesion grows we have to remove it surgically after explaining the patient about the surgery, its complications and the high risk of recurrence.

When to treat? [48]

1. When there is any threat to the vision due to invasion of visual axis
2. Astigmatism and diminished vision
3. Eye movements getting restricted
4. Any features suggestive of dysplasia
5. Rapid increase in size
6. Cosmetic

Medical management

Topical medications

1) Bevacizumab

   There is evidence that Vascular Endothelial Growth Factor (VEGF) was thought to have a role in pathogenesis of pterygia[49]. Bevacizumab may be administered as drops of concentration 25 mg/ml 4 times daily for 3 weeks[50].

2) Cyclosporine A causes reduction in the cellular proliferation.

   0.05 % can be used which will prevent proliferation[51]

3) Mitomycin C (MMC) 0.02 % prevent recurrences but not used due to its side effects.

Subconjunctival medications

Mitomycin C, 5 fluorouracil (5FU), Duanorubicin, Bevacizumab, Traimcinolone and Tiamcinolone with 5 FU can be used. These all help in preventing the recurrences.

Surgical management

The first recorded pterygium surgery was done by Susrutha around 1000 B C. From then many authors have described the procedure in detail

with few modifications from the original procedure recommended by susrutha.

Celsus of Rome passed a thread beneath the pterygium and lifted it from sclera and removed with the help of a scalpel. Scarpa in 1802 was the first one to perform a bare sclera technique

The definitive management of pterygium is surgical excision, the main aim being restoring the normal smooth ocular surface. The pterygium is removed with the help of flat blade dissecting it towards limbus and cut at the base. The closure of the wound involves various methods.

Mc Reynolds procedure The pterygium head is separated from the cornea and the tissue is redirected to the lower fornix. This technique has become outdated.

Bare sclera technique the sclera bed is left bare without closing and allowed to epithelialise. The conjunctiva is either not sutured or secured with sclera with fine sutures. But this technique has a high recurrence rate ranging from 24 to 89 percent[52]. If the defect is very small, we can do simple closure.

Conjunctival autograft technique introduced by Kenyon et al[53] involves the placing the conjunctival flap obtained from the superior or

superotemporal quadrant of the same or the fellow eye on the sclera bed and suturing. The recurrence rate ranges from 2 to 40 percent[54,55].

Modifications of the conjunctival autografts we developed to decrease the recurrence rate. They were

- **Conjunctival limbal autograft** which is more effective in recurrent pterygia and is taken from within 2mm of the limbus.
- **Conjunctival rotation autograft** which is done if we have sacrred superior conjunctiva or limited area of donor tissue as in double headed pterygium. The epithelium is dissected and the inner fibrovascular tissue is removed. The epithelial layer is repositioned after rotating it to 180 degrees.

Intraoperative mitomycin which is an antimetabolite can be used to prevent recurrences. They are used in a concentration of 0.01 to 0.04%. They suppress the ocular fibroblastic activity. The complications rate will be high if we use post operative drops, so single intraoperative dose of short duration application is practiced[56].

Amniotic membrane grafting can also be done. The amniotic membrane is placed with basement membrane facing up and the stroma down. The antiscarring anti inflammatory and anti angiogenic property of the

amniotic membrane is utilized[54]. Studies shows recurrence rate of 2.6 to 10.7 percent in primary pterygium and 37.5 percent in recurrent[57].

Fibrin glue used instead of sutures help us in conserving the time of the procedure,and also decrease the amount of postoperative inflammation[58,59].

Autologous cryoprecipitate glue

The use of autologous cryoprecipitate glue to keep the conjunctival autograft instead of suturing has also been done[60]. This method will cause less discomfort to the patient in terms of post operative pain. This may be superior to the commercially available fibrin glue.

Adjunctive therapies

The pterygium is well known for its recurrences. Adjunctive treatment helped in decreasing the rate of recurrence of pterygium after surgical excision.

Mitomycin C: It is an antibiotic- antimetabolite- antineoplastic agent which has the ability to inhibit fibroblasts. Rapidly dividing cells are the most sensitive to Mitomycin C. MMC is used intraopertively as mentioned previously as well as given to patient postoperatively as

topical drops as 0.2 mg/ml(0.02%) or 0.4 mg/ml(0.04%) drops. Long term use of the topical MMC eye drops can result in ocular toxicity[56].

Beta irradiation inhibits mitosis in dividing cells. It causes ionization changes. Fibroblasts and the tissues with neovascularisation are most succeptible to irradiation thus helping in reducing the recurrences. Irradiation with strontium/yttrium 90 beta irradiation upto a total dose of 50 Gy divided in 4 fractions one week apart. Now it is not used due to the side effects that it can cause like sclera necrosis and melt, cataract formation, and endophthalmitis.

Complications of pterygium surgery[32]

Perforation of globe, thinning of cornea or sclera, intraoperative bleeding, muscle damage can occur intraoperatively.

Early postoperative complication includes persistent epithelial defect, corneal thinning, tear film abnormalities, loss of graft.

Late complication includes recurrences, necrosis of cornea and sclera, endophthalmitis, scleritis. The bare sclera technique has the highest rate of recurrence.

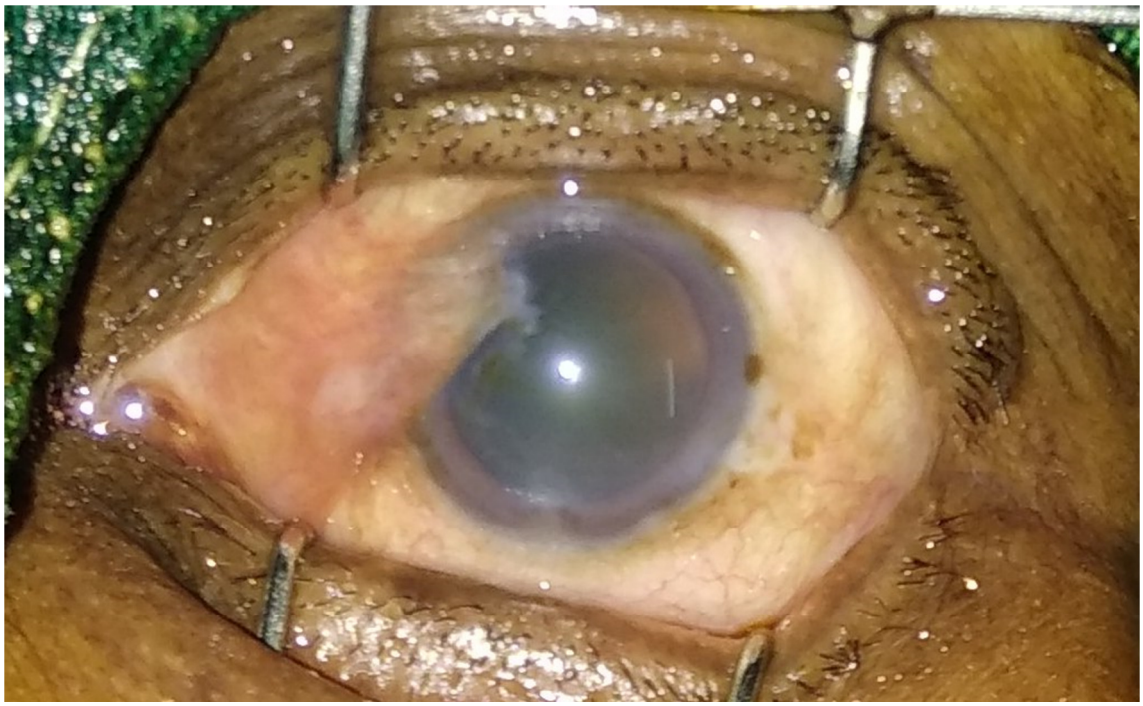


Figure 8 : Nasal pterygium pre excision

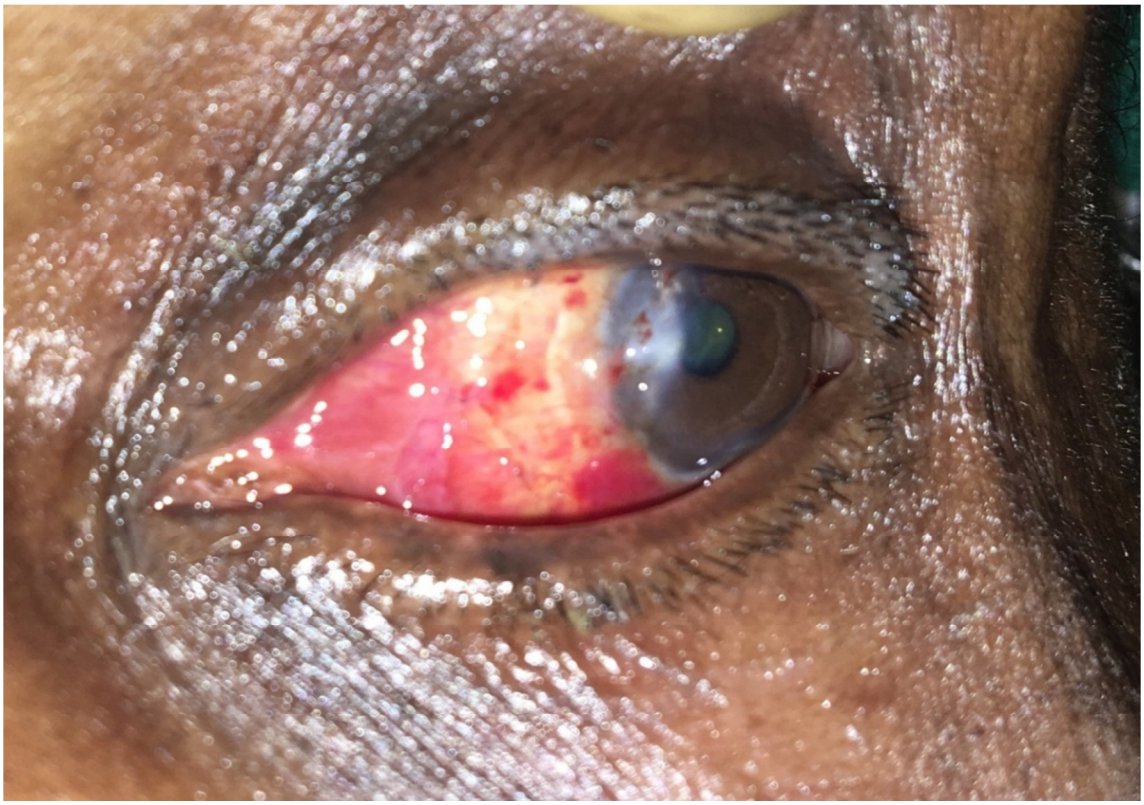


Figure 9 : Nasal pterygium post excision with conjunctival Autograft

REVIEW OF LITERATURE

Mackenzie et al (1992) in his case control study of 278 patients with primary pterygia found that those patients who were outdoor workers with high reflectance surface had higher risk of pterygium compared to those who worked indoor. Those people working on sands had 100 fold and those with concrete surfaces had 20 fold increase in the risk while compared to indoor matched controls[9]. People spending 5 years of their life at 30 degree or less of latitude had 40 times the risk compared to greater than 40. They also found that protective glasses or hats had a strong positive correlation.

Moran et al (1984) in his study in rural Australia involving >64000 aborigines and 40,000 non aborigines found that found a strong positive correlation ($p<0.001$) between pterygium occurrence and the climatic UV radiation[10].

Sekelj et al (2007) evaluated the role of ultraviolet light as a cause of recurrent and primary pterygium in patients who underwent conjunctival autograft. They were grouped as sun exposed and non exposed and followed up for 6-12 months. They concluded that UV light had an important role in the development of both primary and recurrent pterygium[61].

Karai et al (1984) evaluated 191 Japanese welders and found a strong positive correlation with the welding occupation and the duration of occupation as a welder($p=<0.05$) [21].

Ajayi et al (2012) did a descriptive studyon 405 welders who included both arc and gas welders. 50.1 % had pingueculae and 17.5 % had pterygium which was a significant number and concluded that these were the common eye disorders among welders[22].

Shrestha S et al(2014) studied the prevalence of pterygium in high altitude and found that the prevalence was significantly increased in higher than in lower altitudes[27]. Several physiological and pathological changes occurs in the eye at high altitude. The ultraviolet radiation exposure is also higher at higher altitude.

Gupta et al (2008) showed that the prevalence of dry eye is more in high altitudes than in lower[28].

In the study conducted by **Veena M S et al (2013)** on 300 eyes, the maximum number of pterygium patients belonged to the age group of 20-60 years[62]. They could not find any difference in the incidence of pterygium in males and females.

Pandey et al(1983) conducted a study in Agra on 1400 eyes of patients along with 200 control eyes to assess the relationship between pterygia and lacrimation with the help of conventional schirmer's test[63]. They came to a conclusion that the tear production in patients with pterygia was less (average <11 mm) compared to the controls.

M M Balogun et al (2005) in his study concluded that the tear film break up time of <15 seconds was significantly associated with pterygium than controls. People with pterygium had unstable tear film[24].

Saw S M et al stated that cigarette smoking and alcohol increases the risk of developing pterygium[25].

Song et al (2016) in his cross sectional study concluded that smokers had less chance of developing pterygium than non smokers[26].

Booth (1985) in his study on 100 patients admitted for pterygium excision found that 38% had family history of pterygia compared to 12 % of controls[64].

Reisman D et al showed that UV radiation can cause mutation in tumor suppressor gene p 53 and cause uncontrolled cell proliferation[38]. causes loss of its heterozygosity and its inactivation which will cause cell proliferation and genomic instability[39].

Lee et al (2017) showed that the socio economic status of the people was an independent risk factor in the development of the pterygium when other factors were matched. People who were agriculture workers (16.52□±□1.51%) or fishery workers had maximum incidence and the professionals (0.66□±□0.22%)had the least[29].

Safi et al (2016) did a prospective study on 70 eyes with primary pterygia undergoing excision and post operatively the specimen was examined for histopathological analysis[65]. They showed that pterygium redness was significantly related to vascularity but not to the histopathological features. There was a relation of vascular density with the lesion dimension.

Anguria et al (2013) studied 59 samples of pterygia for chronic inflammatory cells and damaged limbal cells and found that chronic inflammatory cells were present in all 59 samples[66]. The counts tend to increase with the increase in size of the pterygia. Most of the pterygia had mild inflammation mostly due to UV exposure. The pterygium occurrence has no association with damaged limbal stem cells.

Nassar et al (2013) did histopathological evaluation(HPE) of 44 pterygium specimens in patients who underwent surgery and showed that they had epithelial and stromal inflammations, vascular proliferation, solar elastosis and fibrosis. 96.2 % were positive for phosphor p 53 and

96.3% ki-67 positive. These indicated high proliferative activity[67]. They did not find any significant difference in HPE of primary and recurrent pterygia.

Raizada et al(1976) did histopathological examination on 10 pingeucula specimen and compared it with pterygium and found that it resembles late sclerotic or early fibrotic phase of pterygium and they concluded that pterygium develops from pinguecula[4].

Maheswari S(2007) assessed the corneal refractive changes induced by pterygium in 151 eyes with primary pterygia by the help of videokeratography[46]. She found that the topographic astigmatism increased with increase in the grade of the pterygium. There occurred a flattening of the horizontal meridian.The corneal astigmatism reduced from 4.40+3.64 dioptre to 1.55+/- 1.63 D following the surgery.

Anguria et al (2014) evaluated 190 patients of pterygia who were followed up 6 months after surgery and compared the recurrence rate between young (50 years) and old(>50 years) patients[68]. It was found that 75% of recurrent pterygium was in young individuals. Those patients had fast growing pterygia.

Tan et al (1998) did a prospective trial in 123 primary and 34 recurrent pterygium eyes who underwent either bare sclera procedure or

conjunctival autograft and found that 61% of the bare sclera group and 2% of the conjunctival autograft group had recurrence[47]. They concluded that conjunctival autografting for both primary and recurrent pterygium reduced the risk of recurremce significantly.

Tananuvat et al(2004) compared the amniotic membrane grafting with the conjunctival grafting for primary pterygium in 86 eyes and found that there was significantly high recurrence rate in the eyes that underwent amniotic membrane graft(40.9%) compared to the conjunctival autograft (4.76%) [69].

Singh et al (2015) concluded in a study that administration of subconjunctival bevazizumab 1 week prior to the surgery as a single dose combined with conjunctival autograft decreases the recurrence rate by decreasing the vascularity of vessels[70].

AIMS AND OBJECTIVES

AIM

To study and analyse the epidemiology of pterygium in tertiary care centre

OBJECTIVES

To document the demography and clinical assessment of pterygium with regards to its size, stage and type.

To analyse the collected data for identifying the risk factors and specific associations and correlations if any.

DESIGN, METHODOLOGY AND TECHNIQUES

Study design:

Cross sectional observational study

Sample size:

104 patients

Study duration:

12 months, from June 2016 to May 2017

Study Population:

The patients with pterygium attending the outpatient clinic of Department of Ophthalmlology of Coimbatore Medical College Hospital who fulfilled the below mentioned selection criteria were included in the study

Inclusion criteria

1. People of age group >20 years
2. True pterygium
3. Patients with other comorbid conditions like diabetes and hypertension
4. Patients with known dry eye syndrome

Exclusion criteria

1. Pediatric patients
2. Patients with fundus pathology
3. Glaucoma patients
4. Pseudopterygium
5. Injuries of eye
6. Suspected ocular surface squamous neoplasia
7. The patients who had asymmetrical pterygium in both eyes

STUDY METHODOLOGY

After selection of the cases, informed consent was obtained in their own language. Data collection was done using a structured questionnaire which comprises of socio-demographic characteristics including age, sex, occupation & detailed history. The exact hours of sun exposure per day

and the years of sun exposure was noted as well as any other ocular or systemic co morbid conditions like diabetes and hyptertension. Patients were grouped into outdoor and indoor workers according to the nature of their occupation. They were categorized as rural and urban population depending on their hometown. Previous history of trauma, smoking habits and alcohol intake were also documented.

For the purpose of analysis the patients coming from areas which were higher than 1000 meters from the sea level were considered as high and less than 1000 considered as low altitude. During symptoms assessment care was taken to find out if patient had any dry eye symptoms like irritation and burning sensation.

A complete ocular examination was done and recording of the uncorrected and best corrected visual acuity along with the degree of astigmatism was done with the help of automated keratometry. Astigmatism was recorded as with the rule, against the rule or oblique astigmatism.

For the purpose of analysis pterygium of one eye was considered in bilateral cases. The asymmetric bilateral cases were excluded from the study. Detailed slit lamp examination to find the stage and measurement of the pterygium was done. It was classified as stage I- restricted to

limbus, stage 2- marginally invade the cornea, stage 3- between limbus and pupillary margin and stage 4- central to the papillary margin.

Pterygium was classified as regressing, intermediate or fleshy pterygium according to Tan et al classification[47] based on the visibility of episcleral vessels. The position of pterygium was documented as nasal, temporal or double pterygium as well as whether the patient is having unilateral or bilateral pterygium.

The tear film assessement was done with the help of Schirmers test and tear film break up time (TBUT). Schirmers strip was placed in the lower fornix at the junction of medial and lateral 2/3rd and the measurement was taken after 5 minutes. TBUT was done under the guidance of slit lamp with the help of 2% flourescein strip to stain the tear film. The time taken for the first dark spot to appear is calculated in seconds. Both the values of Schirmers test and TBUT was grouped into 2 for analysis. Those who had less than 10 seconds were considered as dry eye and more than 10 as normal value.

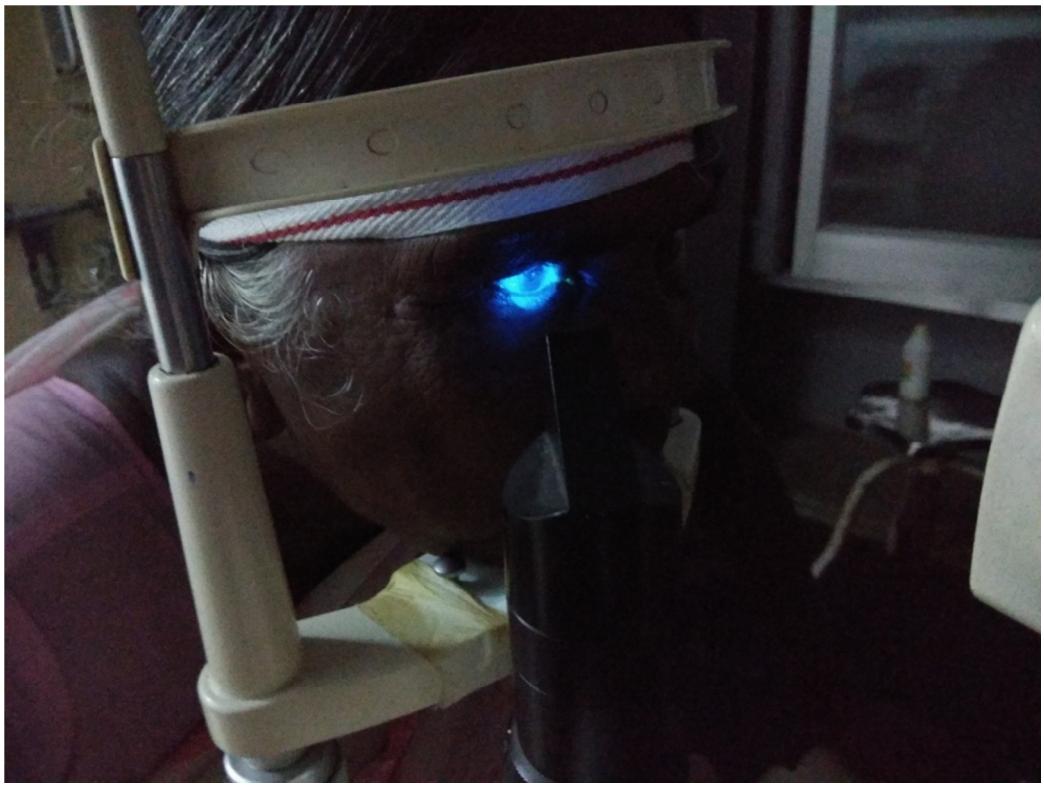


Figure 10 : Examination of tear film break up test

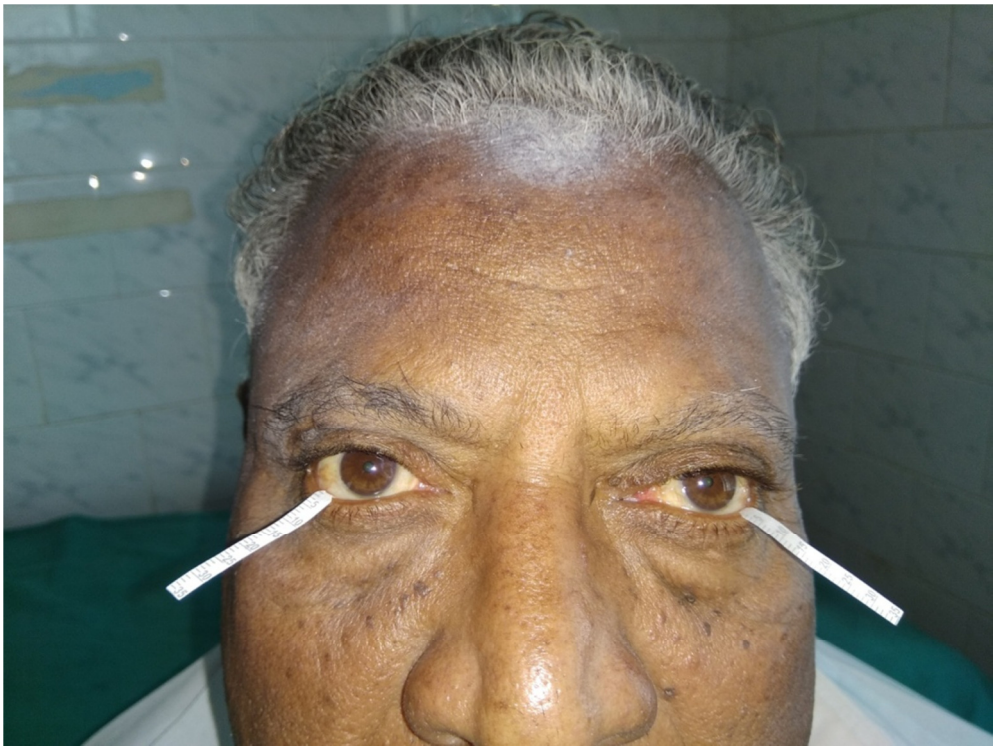


Figure 11: Schirmer's test

STATISTICAL ANALYSIS

Data analysis was performed using statistical software package SPSS version 22.0. Both descriptive and inferential statistics were used. The data of categorical and ordinal variable were represented as frequencies and proportions. The data of continuous variable was represented as mean +/- standard deviation or mean based inter quartile range depending on the distribution of data. The comparison of continuous variable across different subgroups was done using one way analysis of variance (ANOVA). The comparison of categorical and ordinal variable across different subgroups were done using chi square test. Correlation analysis was done by estimating Pearson estimation co-efficient. P value of less than 0.05 was considered significant.

RESULTS AND OBSERVATIONS

DEMOGRAPHIC CHARACTERISTICS OF PARTICIPANTS

Demographic and clinical data of 104 patients are presented below

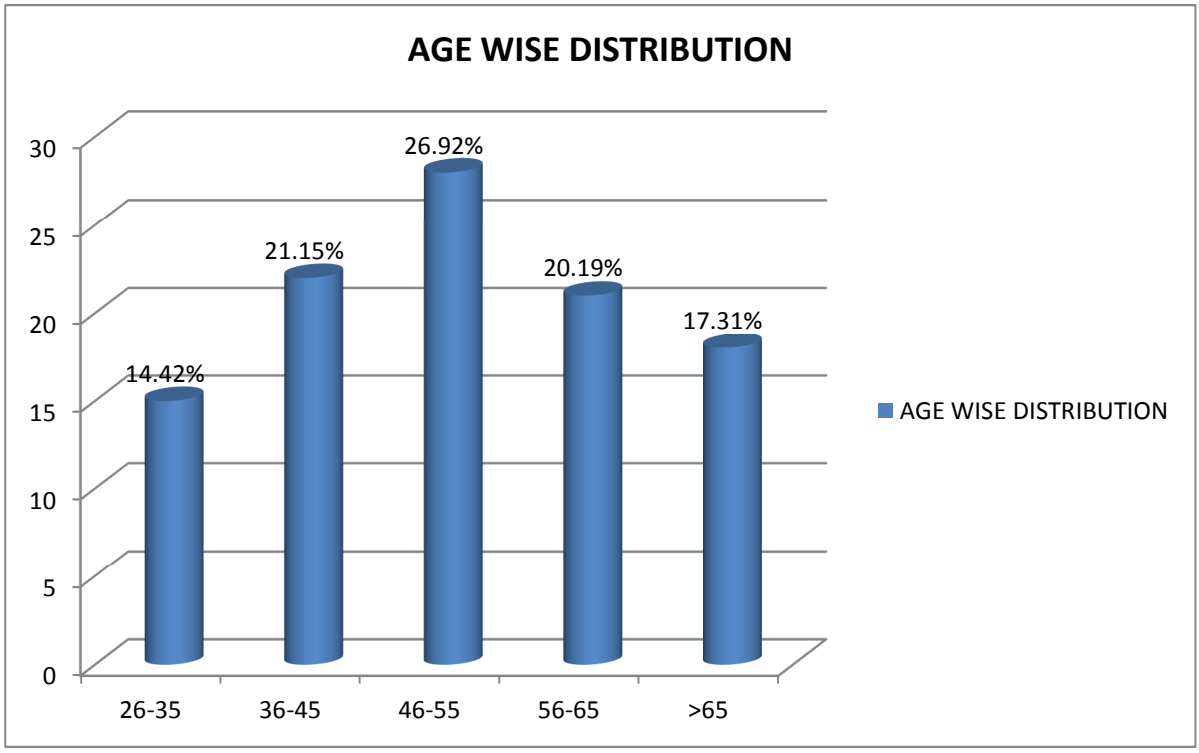
AGE DISTRIBUTION

Age of the patients ranged from 27 years to 78 years. The mean age of the study population is 51.5 years, the standard deviation being 13.5 years.

TABLE 01: Age distribution of study participants

Age group	Frequency	Percentage
26-35	15	14.42
36-45	22	21.15
46-55	28	26.92
56-65	21	20.19
>65	18	17.31
Total	104	100.00

CHART 01



Majority of the patients belonged to the age group of 46- 55 (n=28, 26.92%). None of the patients were less than 25 years.

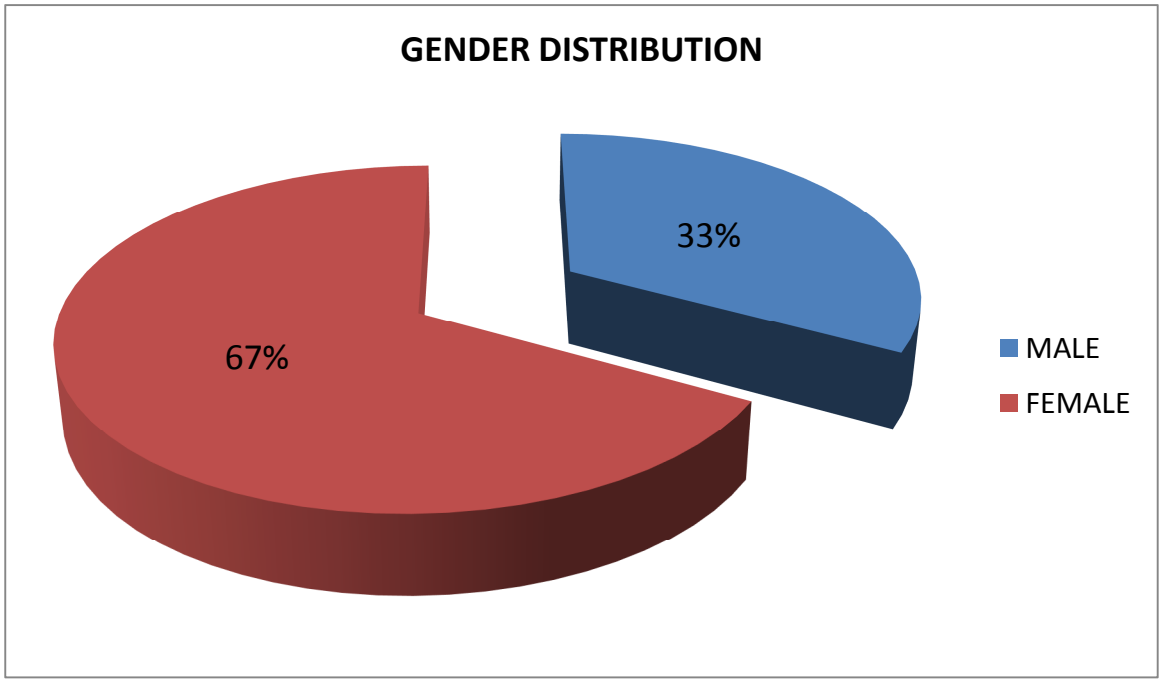
GENDER DISTRIBUTION

Females were more in the study group (n=70, 67%)

TABLE 02- Gender distribution

SEX	FREQUENCY (n)	PERCENTAGE (%)
Male	34	33
Female	70	67
Total	104	100

CHART 02



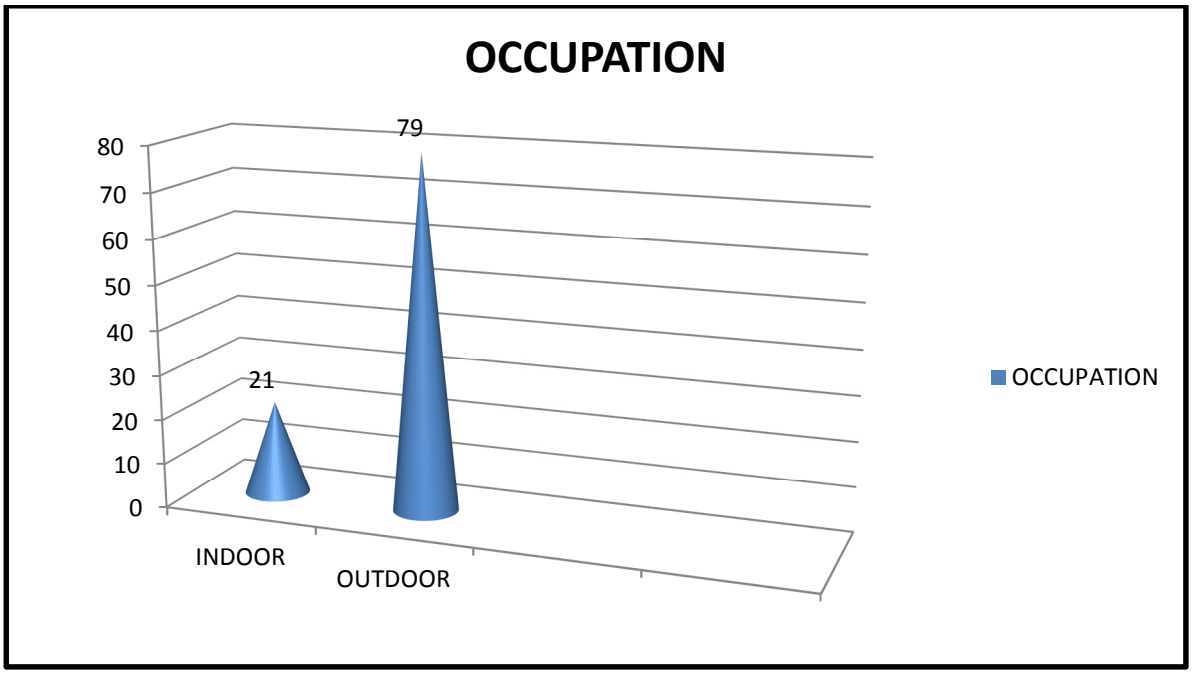
OCCUPATION

Majority of patients were engaged in outdoor works (n=82, 79%)

TABLE 03

OCCUPATION	FREQUENCY (n)	PERCENTAGE (%)
Indoor	22	21
Outdoor	82	79
Total	104	100

CHART 03



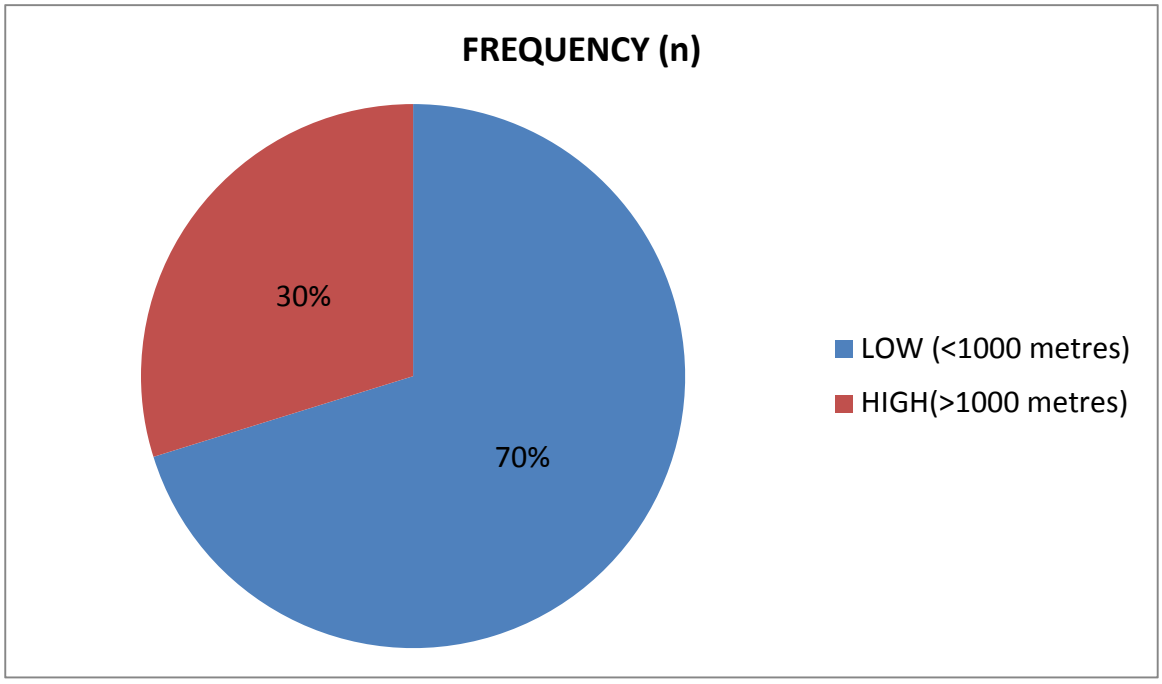
ALTITUDE

Most of the subjects were from low altitude areas (n=73, 70%)

TABLE 04

ALTITUDE	FREQUENCY (n)	PERCENTAGE (%)
Low (<1000 Metres)	73	70
High(>1000 Metres)	31	30
Total	104	100

CHART 04

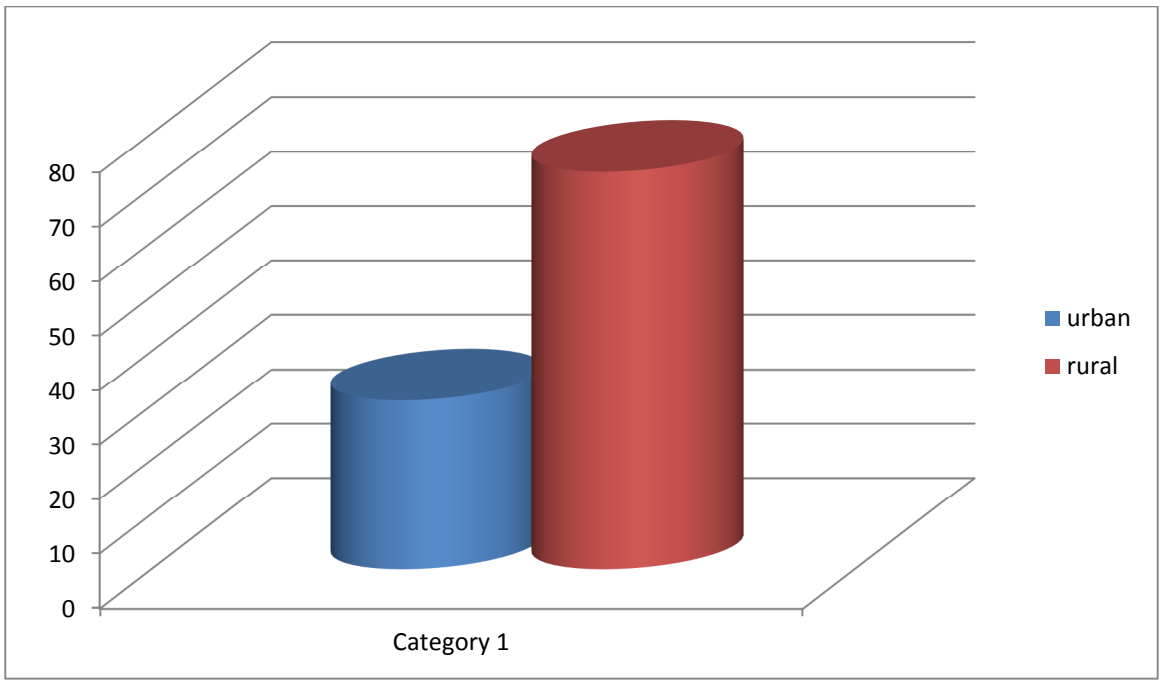


RESIDENTIAL STATUS (URBAN/RURAL)

TABLE 05

	FREQUENCY	PERCENATAGE
Urban	31	29.8
Rural	73	70.2
Total	104	100

CHART 05

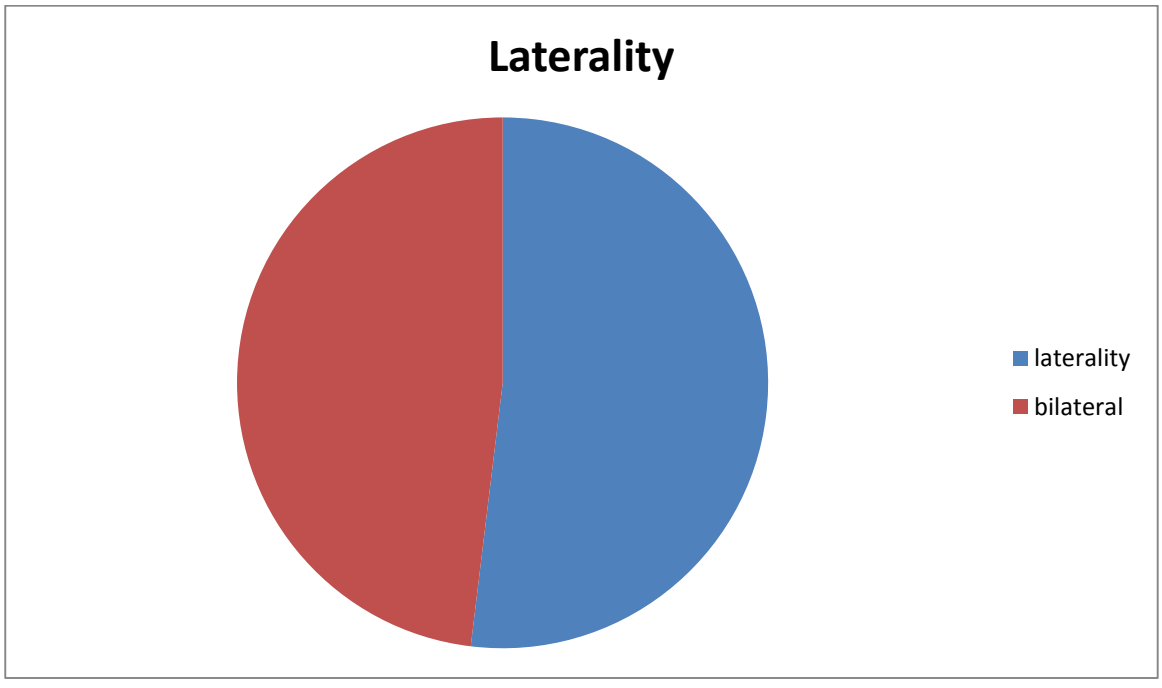


LATERALITY OF PTERYGIUM

TABLE 06

LATERALITY	FREQUENCY	PERCENTAGE
Unilateral	54	51.9
Bilateral	50	48.1
TOTAL	104	100

CHART 06

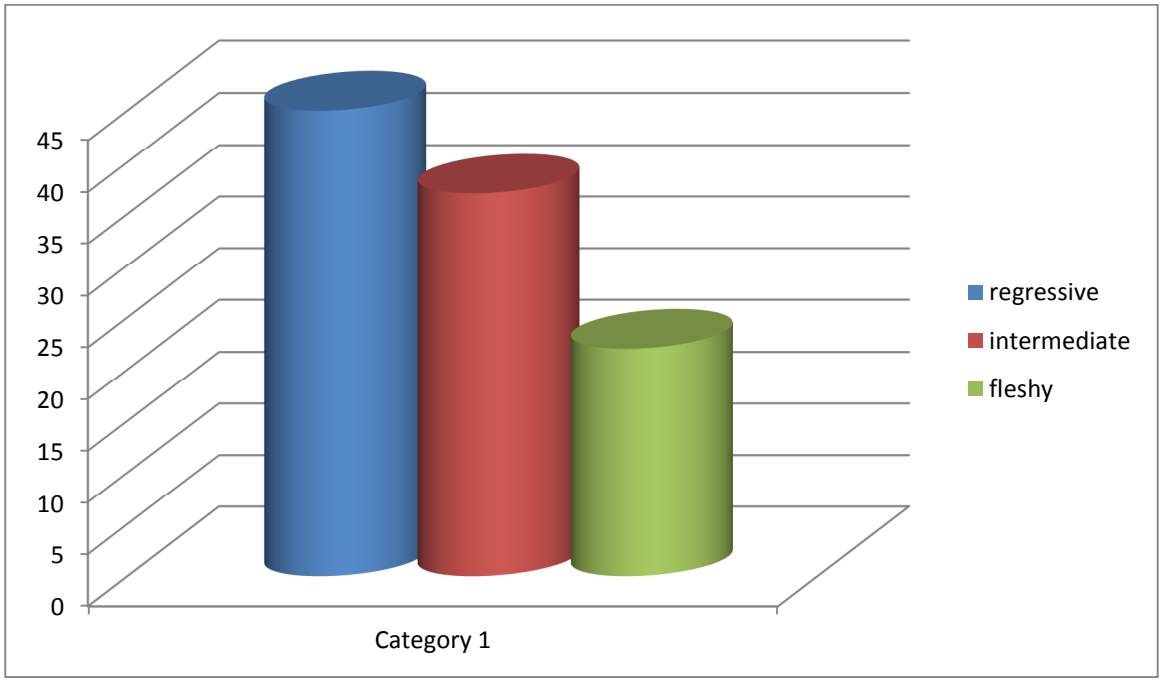


TYPE OF PTERYIGUM

TABLE 07

Type of pterygium	Frequency	Percentage
Regressive	45	43.27
Intermediate	37	35.58
Fleshy	22	21.15
Total	104	100

CHART 07

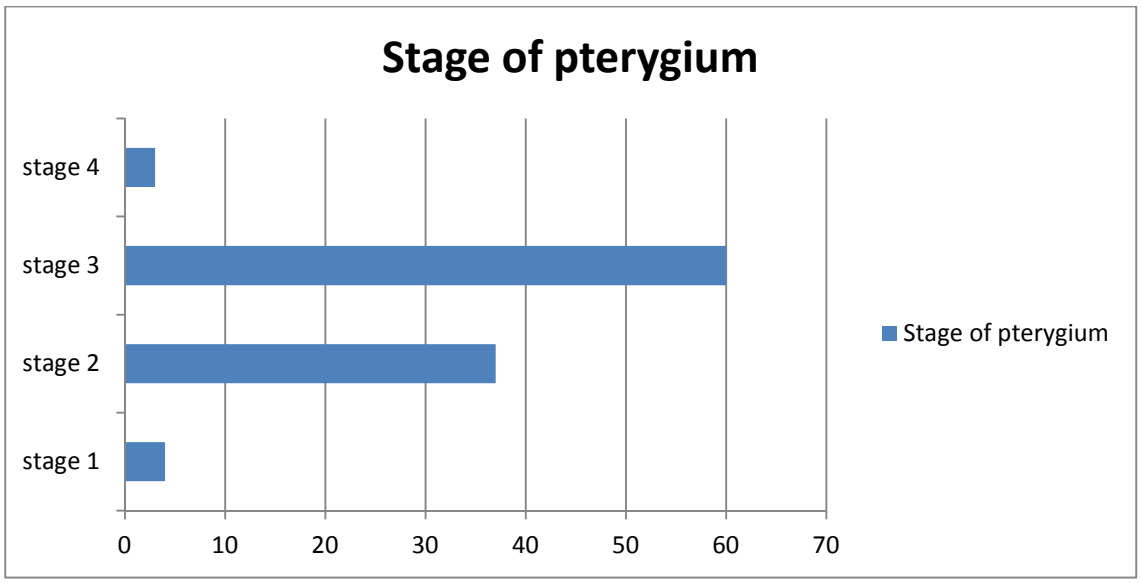


STAGE OF PTERYGIUM

TABLE 08

STAGE	FREQUENCY	PERCENTAGE
1	4	3.85
2	37	35.58
3	60	57.69
4	3	2.88
Total	104	100

CHART 08

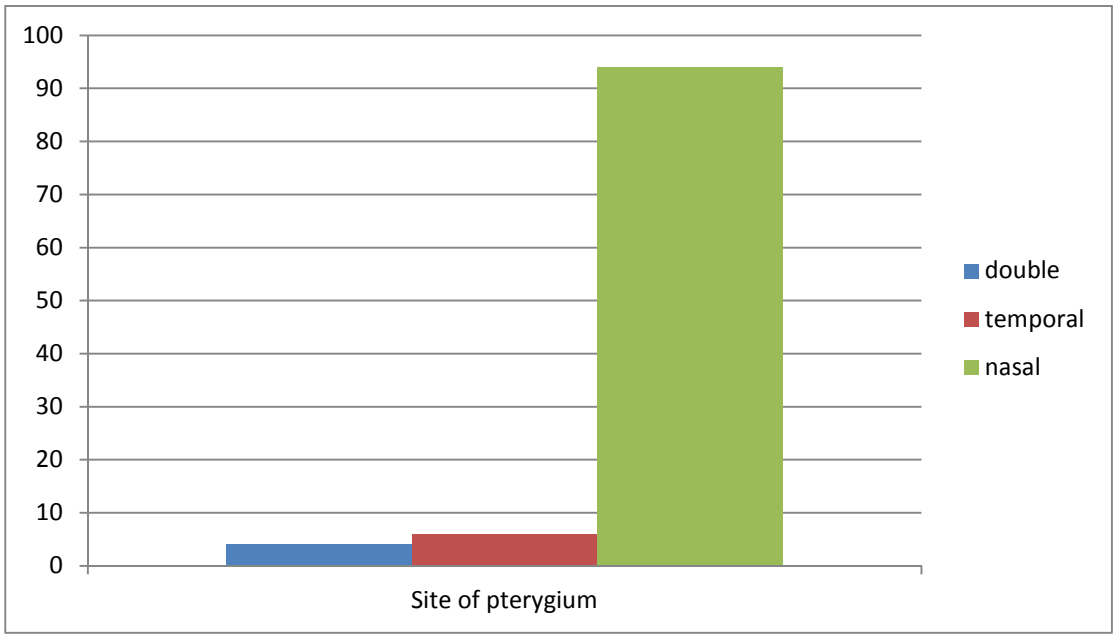


SITE OF PTERYGIUM

TABLE 09

SITE OF PTERYGIUM	FREQUENCY	PERCENTAGE
Nasal	94	90.4
Temporal	6	5.8
Double	4	3.8
Total	104	100

CHART 09



SUN EXPOSURE

Mean sun exposure hours-5.7 hours per day (SD.2.7hours)

Mean years of sun exposure: 27.7 years (SD 11.7)

TABLE 10

		FREQUENCY	PERCENTAGE
Hours of sun exposure	<=4 hours per day	23	22.1
	>4 hours per day	81	77.9
Years of sun exposure	<=20 years	38	36.5
	>20 years	66	63.5

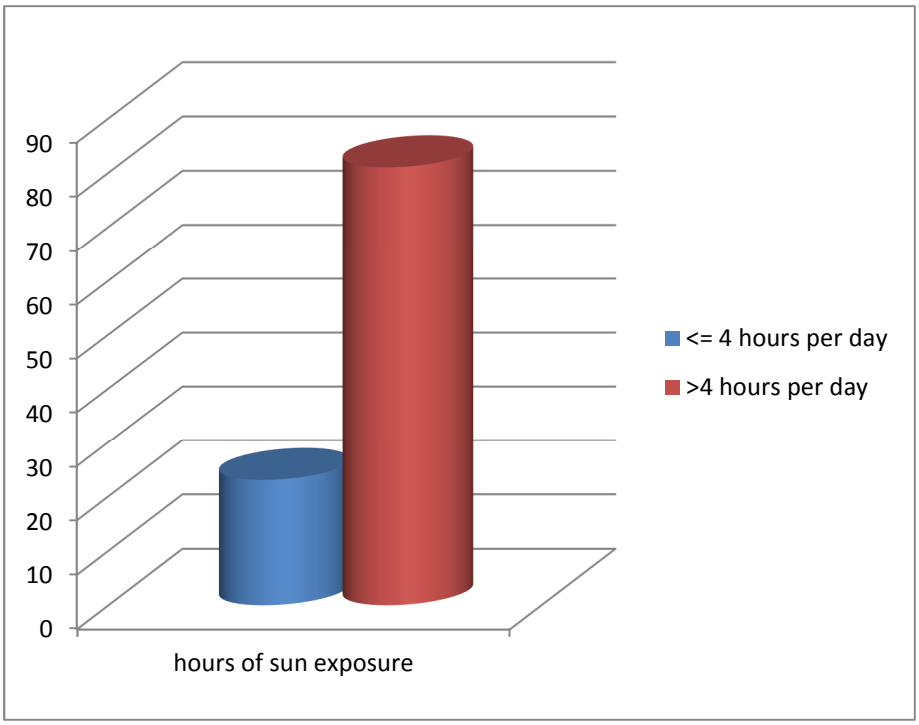
The patients engaged in indoor working had less than 4 hours of sun exposure per day and those working outdoor had 4- 9 hours of exposure per day.

77.9 % (n=81) had significant sun exposure per day (>4 hours).

63.5% (n=66) were exposed to long duration of sunlight for more than 20 years.

SUN EXPOSURE

CHART 10



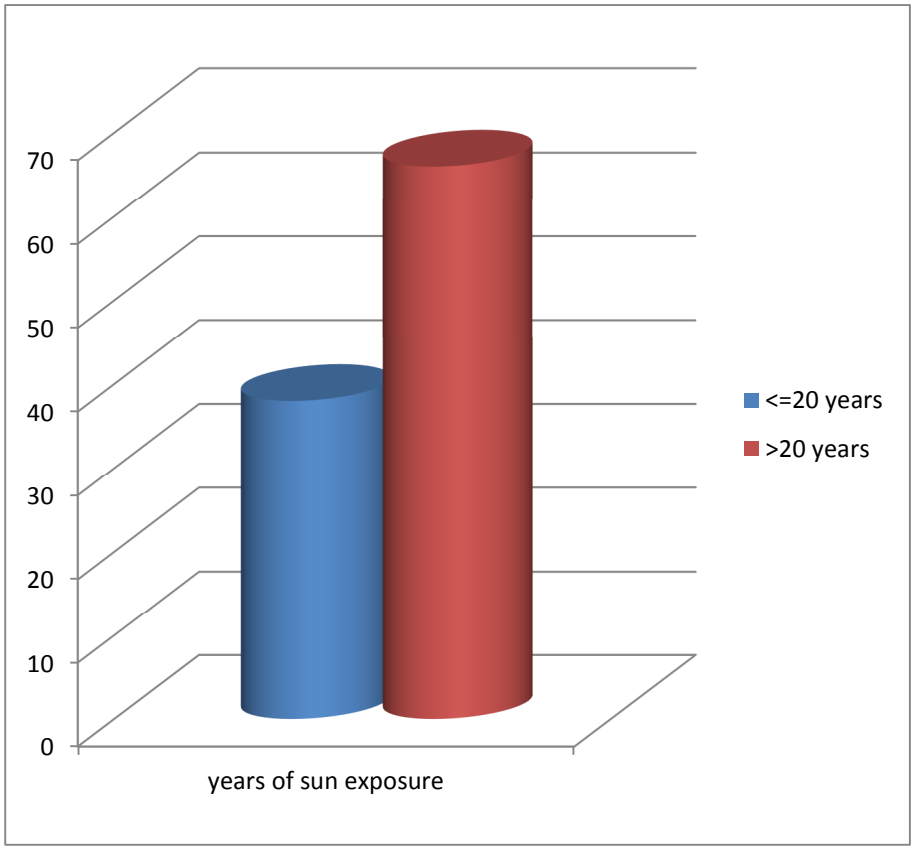


TABLE 11

Daily hours of sun exposure and type of pterygium

Type of Pterygium	Regressive	Intermediate	Fleshy
Sun exposure in hours (Median – IQR)	6 (6-7)	6 (2.5-7.5)	7 (6-8)

Duration of sun exposure is not significantly different across types (Kruskal Wallis test, P = 0.087). But it is close to the significance.

CHART 11

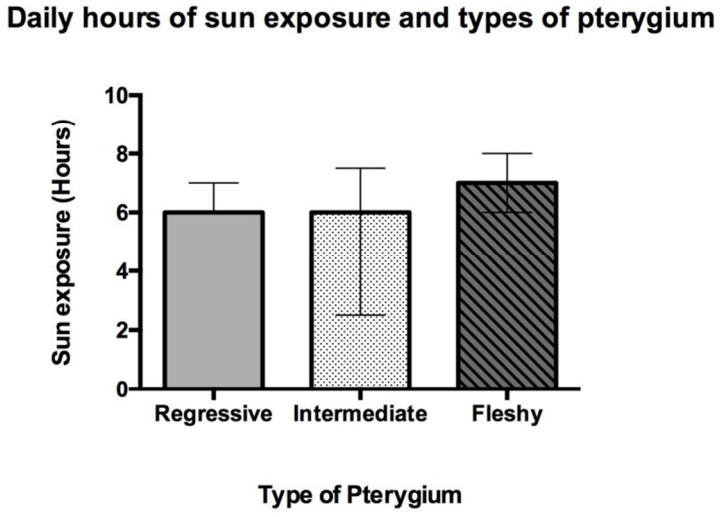


TABLE 12

Years of sun exposure and type of pterygium

Type of Pterygium	Regressive	Intermediate	Fleshy
Sun exposure in years (Mean ± SD)	24.38 ± 12.20	24.68 ± 8.94	34.77 ± 11.28**

Years of sun exposure is significantly higher in the fleshy type in comparison to regressive ($p<0.01$) and intermediate types ($P<0.01$) (One way ANOVA overall, $P = 0.0008$)

CHART 12

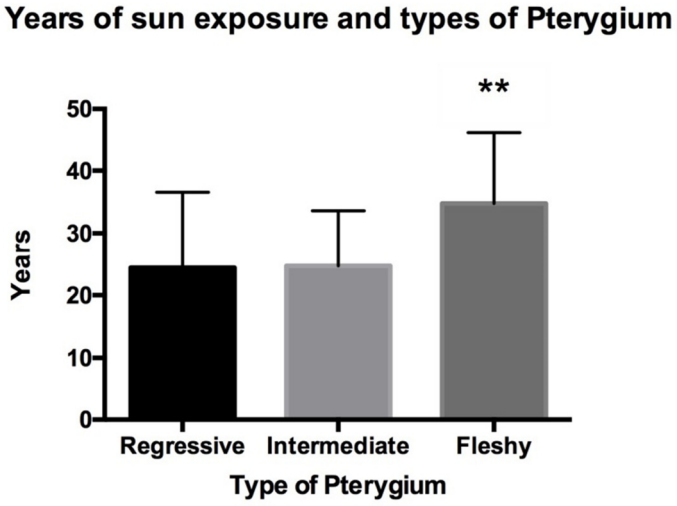


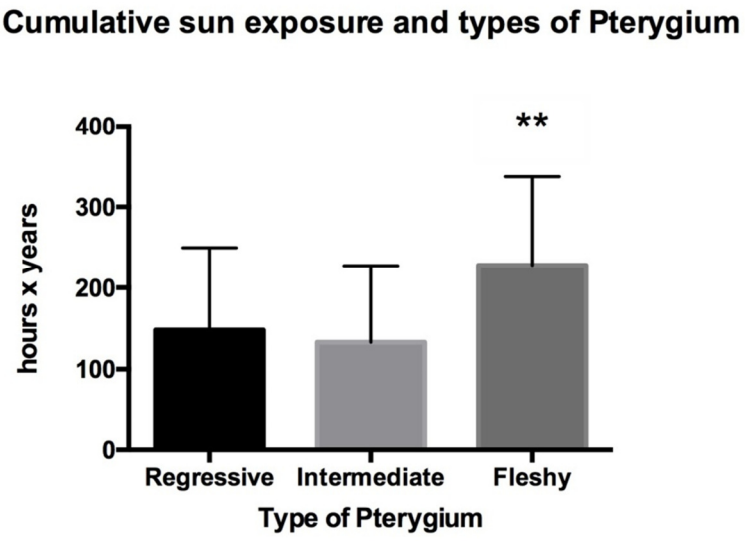
TABLE 13

Cumulative hours of sun exposure and type of pterygium

Type of Pterygium	Regressive	Intermediate	Fleshy
Sun exposure in years x hours (Mean ± SD)	148± 101	133± 93	227± 109**

Cumulative sun exposure is significantly higher in the fleshy type in comparison to regressive ($p<0.01$) and intermediate types ($P<0.01$) (One way ANOVA overall, $P = 0.002$)

CHART 13



COMORBID CONDITIONS & SMOKING

TABLE 14

	Present /Absent	Frequency	Percentage
Diabetes	Yes	28	26.9
	No	76	73.1
Hypertension	Yes	31	29.8
	No	73	70.2
Either diabetes or hypertension	Yes	45	43.3
	No	59	56.7
Smoking	Yes	24	23.1
	No	80	76.9

TABLE 15

Diabetic status and type of pterygium

Type of Pterygium	Regressive	Intermediate	Fleshy
Proportion of diabetics	12/45	8/37	8/22

Proportion of the patients with diabetes as a comorbid risk factor was not significantly different across the various types (Chi square test for trend P = 0.52)

TABLE 16

Hypertensive status and type of Pterygium

Type of Pterygium	Regressive	Intermediate	Fleshy
Proportion of Hypertensives	15/45	9/37	7/22

Proportion of the patients with Hypertension as a comorbid risk factor was not significantly different across the various types (Chi square test for trend P = 0.75)

TABLE 17

Smoking and type of Pterygium

Type of Pterygium	Regressive	Intermediate	Fleshy
Proportion of patients who are smokers	7/45	11/37	6/22

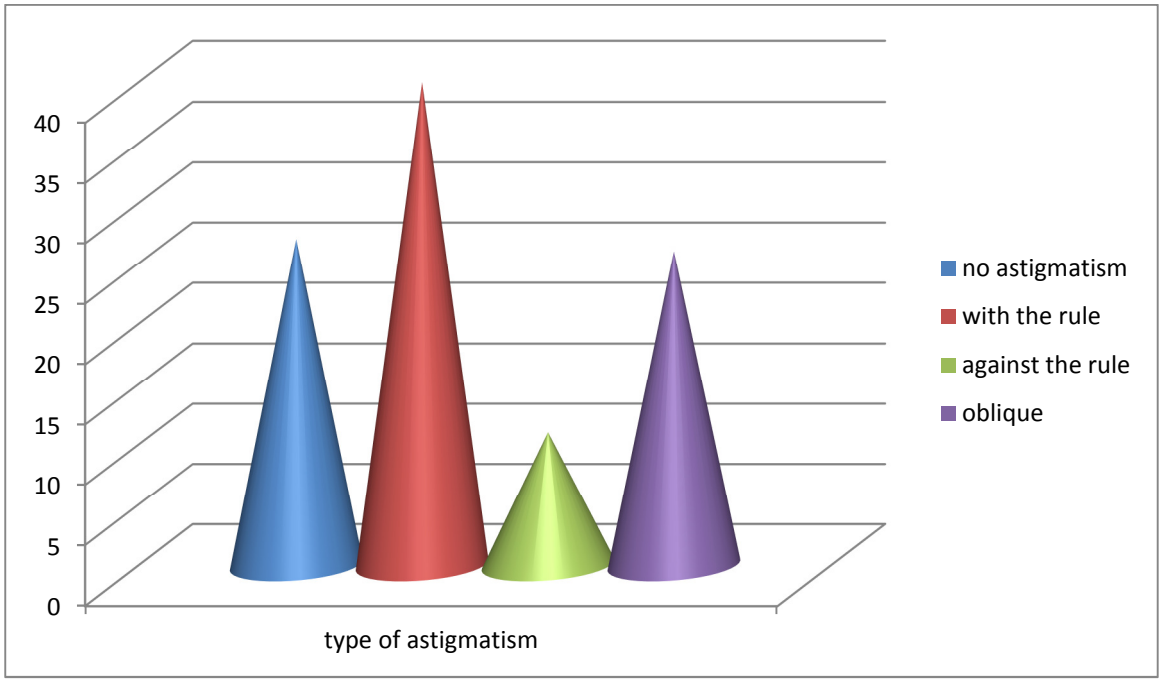
Proportion of the patients who were smokers was not significantly different across the various types (Chi square test for trend P = 0.19)

ASTIGMATISM

TABLE 18

ASTIGMATISM TYPE	FREQUENCY	PERCENTAGE
No astigmatism	27	25.96
With the rule	40	38.46
Against the rule	11	10.58
Oblique	26	25.00

CHART 14



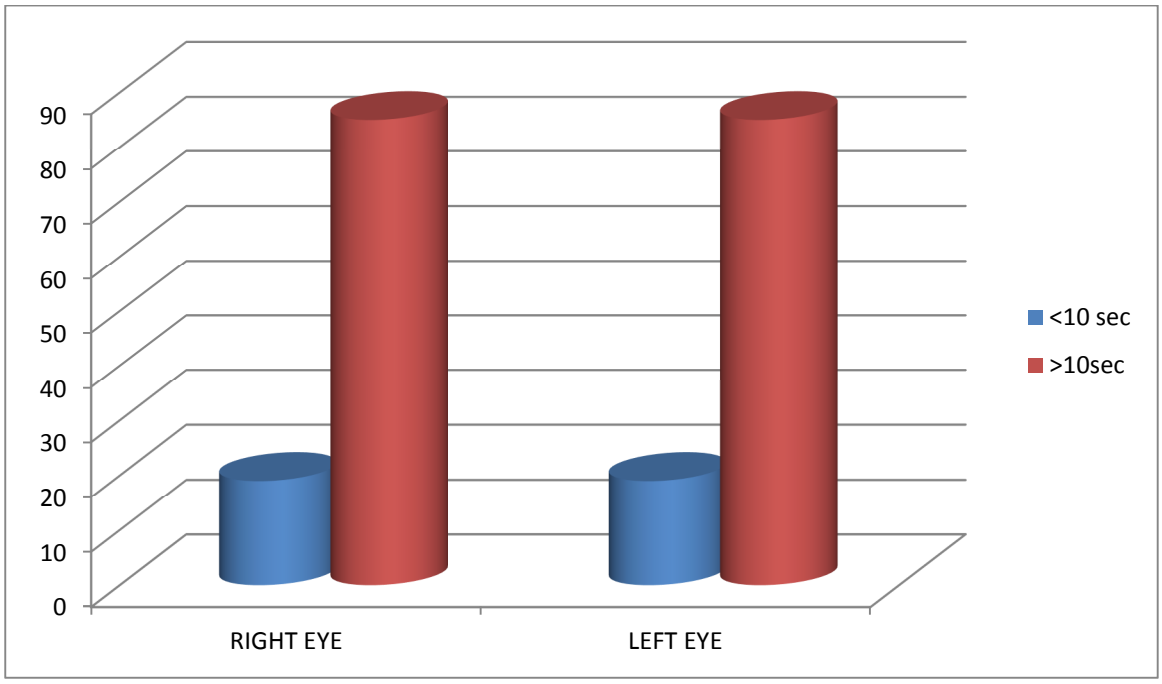
In both the eyes the patients were found to have more with the rule astigmatism

TEAR FILM BREAK UP TIME

TABLE 19

TBUT in seconds	Right Eye		Left eye	
	Frequency	Percent	Frequency	Percent
>10	85	81.73	85	81.73
<10	19	18.27	19	18.27
Total	104	100	104	100

CHART 15

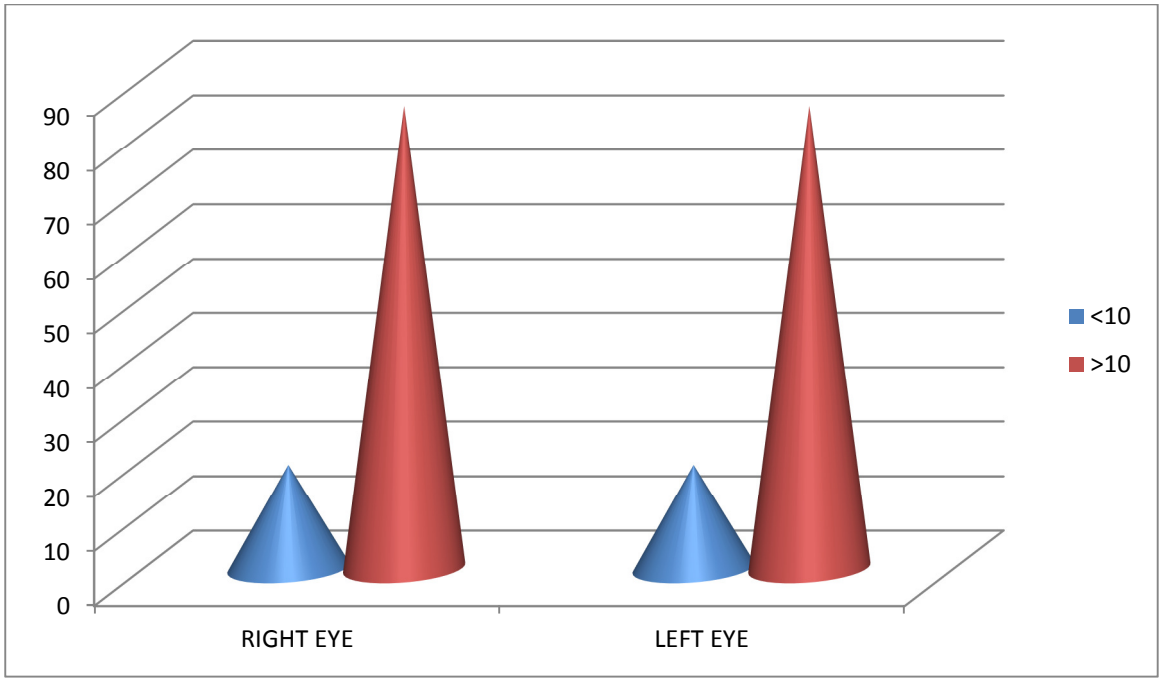


SCHIRMERS TEST

TABLE 20

Schirmers test (mm)	Right Eye		Left eye	
	Frequency	Percent	Frequency	Percent
>10	85	81.73	85	81.73
<10	19	18.27	19	18.27
Total	104	100	104	100

CHART 16



DRY EYE

TABLE 21

DRY EYE	FREQUENCY	PERCENTAGE
No dry eye	85	81.73
Dry eye	19	18.27
TOTAL	104	100

TABLE 22

Dry eyes and type of Pterygium

Type of Pterygium	Regressive	Intermediate	Fleshy
Proportion of patients with dry eyes	7/45	10/37	2/22

Proportion of the patients with dry eyes as a risk factor was not significantly different across the various types (Chi square test for trend P = 0.79)

DISCUSSION

Our study included 104 subjects who were diagnosed to have true pterygium in either or both of the eyes.

The mean age of the patients in our study was 51.5 years with a standard deviation of 13.5 years, which is comparable to previous studies. Youngest patient was 27 years and the oldest 78 years.

In our study group most of the patients presented with cataract related diminished vision and pterygium was incidentally detected, which explains the cause of slightly older age group of presentation in our study.

15 patients (14.42%) were in the age group 26-35, 22 (21.15%) in the age group 36-45, 28(26.92%) in the age group 46-55, 21(20.19%) in the age group 56-65 and 18 (17.31%) in the age group >65 years, in our study. Majority of the patients presented in the age group of 45 to 55 years (n=28, 26.92%)

Females were predominant in our population (n=70, 67%). Most of the previous studies have shown an increased incidence of pterygium in males, as men were commonly involved in outdoor works. [16]. Our study population consisted of the people coming from low socioeconomic

conditions were ladies involved in outdoor occupation. This may account for the increased number of female pterygium cases in our study.

Our study had 79% of outdoor workers (n=82). The outdoor works included manual labourers, farmers, tea estate workers, concrete workers, coconut climbers and building painters. The association of UV light with occurrence of pterygium is well documented in previous studies[6,9,10].

Mean sun exposed hours was 5.7 hours per day with a standard deviation of 2.7 hours and mean year of sun exposure was 27.7 years with a standard deviation of 11.7 years. The average daily duration of sun exposure was not significantly different across types of pterygium (p=0.087). However the years of sun exposure (p=0.008) and cumulative hours of sun exposure (p=0.002) were significantly higher in the fleshy type.

Most of the patients in our study were from the rural area (n=74, 70.2%). Rural area and low socioeconomic status are associated with more amount of outdoor work and more UV exposure. These people will have low level of education and may not be aware of the harmful effects of the UV light and thus don't adopt protective measures such as hats and glasses[29].

On comparing the low and high altitude, it was seen that majority of patients came from the low altitude regions (n=73,70%) compared to high (n=31, 30%) . The statistical significance between the effect of high altitude and pterygium was low in this study. This could be due to the small sample size of the patients coming from high altitude. However it is well documented that people living in high altitude has higher chance developing pterygium because of the higher UV light exposure along with dry eye[25,28].

Most of the patients presented with irritation and burning sensation (n=44, 42.3%) as their chief complaints. The rest presented with growth in the eye (n=22. 21.1%), gradual onset of blurring of vision (n=26,25%) or redness (n=12, 11.5%) as their presenting complaints..

We could not find any significant association between diabetes (p=0.52) and hypertension (p=0.75) with the type of the pterygium, in our study. No such correlation was documented in other studies also. The diabetic patients have more chance of developing tear film instability thereby making the eye more vulnerable to UV damage.

54 cases (51.9%) cases in our study were unilateral and 50 (48.1%) were bilateral. Nasal pterygium (n=94, 90.4%) were more common than temporal (n=6, 5.8%) or double pterygium (n=44, 3.8%). On comparing

the type of the pterygium, regressive type was found to be more (n=45, 43.27) than fleshy (n=22, 21.15) and intermediate (n=37, 35.58%) types.

In our study 4 patients (3.85%) belonged to stage 1, 37 patients (35.68%) stage 2, 60 patients (57.68%) stage 3 and 3 patients (2.58%) stage 4. Most of the patients belonged to stage 2 and 3 which could be due to better awareness.

Dry eye was found to be present in 19 patients (18.27%). Even though dry eye may be a risk factor for pterygium, statistical correlation could not be established in our study due to the small sample size (p=0.79).

In the study group 50 patients (48.1%) had bilateral pterygium. 94 patients (90.4%) had nasal pterygium and 4 patients (3.8%) had double pterygium. The sun rays going laterally through cornea, undergoing refraction and getting focused at the limbus on the nasal side can be an explanation for the nasal predominance. Sunlight from lateral side go unobstructed through the cornea to medial side. The nose reduces the amount of sunlight falling on the lateral side. Even though it is unusual to find a temporal pterygium alone but it is not unlikely.

Out of 104 patients 77 patients (74.04%) had astigmatism among which maximum were having with the rule astigmatism (n=40, 38.46%). This is in accordance with the other studies[46].

SUMMARY

Our study entitiled 'AN ANALYTICAL STUDY ON THE STUDY OF EPIDEMIOLOGY PTERYGIUM IN TERTIARY CARE CENTRE' was a hospital based cross sectional study.

The aim of the study was to study and analyse the epidemiology of pterygium in tertiary care centre

The objective of the study was to document the demography and clinical assessment of pterygium with regards to its size, stage and type and to analyse the collected data for identifying the risk factors and specific associations and correlations if any.

Middle aged to elderly people is more affected due to their prolonged exposure to inciting agents in the environment. Majority of the patients in our study were in the age group 45 to 55years.

70 patients were females in our study but there is no significant gender predilection, if the environmental factors are the same.

Mean sun exposed hours was 5.7 hours per day in our study. The average daily duration of sun exposure was not significantly different across types of pterygium. However the years of sun exposure and

cumulative hours of sun exposure were significantly higher in the fleshy type.

74 patients were from the rural area and 73 patients were from low altitude regions in our study. Rural area and low socioeconomic status are associated with more amount of outdoor work and more UV exposure. These people will have low level of education and may not be aware of the harmful effects of the UV light and thus don't adopt protective measures such as hats and glasses.

In our study no significant association between high altitude and pterygium were found because of the low sample size.

We could not find any significant association between diabetes and hypertension with the type of the pterygium, in our study. No such correlation was documented in other studies also.

19 patients in our study group were diagnosed to have dry eye, with a break up time <10 seconds and schirmers <10 mm. Most of them were clinically asymptomatic.

Most common clinical symptoms include irritation and foreign body sensation in eye, visual disturbances, redness and visible growth in eye.

Visual disturbances in pterygium are due to obscuration of visual axis by the growth of pterygium, astigmatism and coexisting cataract. With the rule astigmatism are more commonly associated with pterygium.

CONCLUSION

Pterygium is one of the very commonly encountered ocular conditions in our country, especially affecting people of low socioeconomic strata. It amounts to significant visual morbidity of our population. Proper understanding of the epidemiology and risk factors of this condition is essential for planning appropriate measures to prevent its occurrence and thereby reducing the physical and financial burden to the society.

The role of prolonged sunlight and UV light exposure is a proven risk factor. Patient working outdoors should be counseled about the importance of wearing protective eye gears.

It should be emphasized that such protective measures can not only delay the onset but also the progression of pterygium to some extent.

Adequate management of asymptomatic dry eye is mandatory especially in patients working outdoors, as it can play a contributory role and hence the importance of dry eye evaluation in all cases of pterygium.

Even though most of the study populations were from lower altitudes, the role of high altitude in the genesis of pterygium definitely needs to be considered.

Though co morbid conditions like hypertension and diabetes do not play any role in the initiation and progression of pterygium, they can still contribute further to the visual morbidity.

As pterygium is usually a bilateral disease and the development of one eye always precedes the other, educating the patient can delay the progression in the affected eye and also to reduce the risk of pterygium developing in the other eye to some extent.

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DATA SHEET

NAME:

AGE: SEX: OCCUPTION:

ADDRESS:

Urban/rural

HISTORY

1. Presenting complaints
2. Symptoms of dry eye
3. Daily sun exposed hours
4. h/o trauma
5. Any ocular comorbidites
6. Systemic comorbidities
7. h/o smoking/alocohol
8. previous h/o pterygium

RE

LE

1.Uncorrected visual acuity(UCVA) :

2.Refraction : SPH

CYL

AXIS

3.Best corrected visual acuity(BCVA):

4.Tonometry-Non contact tonometry:

5.Slit Lamp Examination

Lids :

Conjunctiva :

Cornea :

Anterior chamber :

Iris :

Pupil :

Lens :

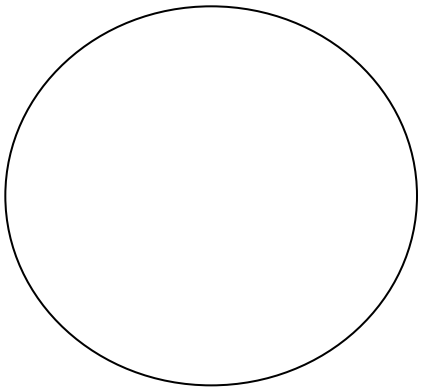
6. Tear film break up test :

7. Schirmmers test :

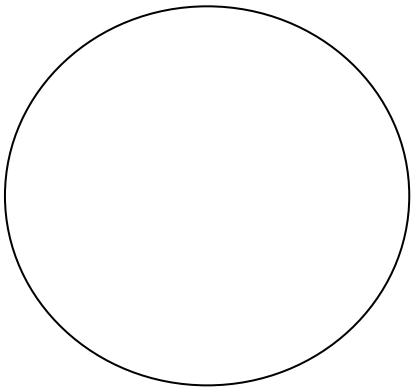
8.Fundus examination

Direct Ophthalmoscopy , +90 D and Indirect Ophthalmoscopy

RIGHT EYE



LEFT EYE



CONSENT FORM

Here by I volunteer and consent to participate in this study "analytical study on epidemiology of pterygium in a tertiary care centre". I was fully explained about the nature of this study by the doctor; knowing which I Mr / Ms …….. fully consent to volunteer in this study.

Signature of the volunteer

Date:

Place: Signature of the witness

CONSENT FORM

I Dr. Swetha. K, is carrying out a study on the topic, "ANALYTICAL STUDY ON EPIDEMIOLOGY OF PTERYGIUM IN A TERTIARY CARE CENTRE".

My research project guide is **Dr.M.Hemanandini M.S.,D.O**.

My research project is being carried out in the Department of Ophthalmology, Coimbatore Medical College Hospital, Coimbatore.

RESEARCH BEING DONE:

ANALYTICAL STUDY ON EPIDEMIOLOGY OF PTERYGIUM IN A TERTIARY CARE CENTRE

PURPOSE OF RESEARCH

To document the demography and clinical assessment of pterygium with regards to its size, stage and type.

To analyse the collected data for identifying the risk factors and specific associations and correlations if any To study about the following factors in patients with pterygium,

PROCEDURES INVOLVED:

Diagnosis of pterygium will be done clinically and a questionnaire will be administered to study about the demographic profile and the risk factors of pterygium. Complete visual examination will be done. The investigations like tear film analysis will be performed to identify the risk factors.

You, Shri./ Smt./ Kum. _____, aged ____ years, S/o / D/o / W/o _____, residing at _____ _____ are requested to be a participant in the research study titled 'ANALYTICAL STUDY ON EPIDEMIOLOGY OF PTERYGIUM IN A TERTIARY CARE CENTRE' in Government Medical College Hospital, Coimbatore. You satisfy eligibility criteria as per the inclusion criteria. You can ask any questions or seek any clarifications on the study that you may have before agreeing to participate.

DECLINE FROM PARTICIPATION

You are hereby made aware that participation in this study is purely voluntary and honorary and that you have the option and the right to decline from participation in the study.

PRIVACY AND CONFIDENTIALITY

You are hereby assured about your privacy. Privacy of subject will be respected and any information about you or provided by you during the study will be kept strictly confidential.

AUTHORIZATION TO PUBLISH RESULTS

Results of the study may be published for scientific purposes and/or presented to scientific groups, however you will not be identified; neither will your privacy be breached.

STATEMENT OF CONSENT

I, _____, do hereby volunteer and consent to participate in this study being conducted by **Dr.Swetha.K**. I have read and understood the consent form / or it has been read and explained to me in my own language. The study has been fully explained to me, and whenever I ask questions at any time.

Signature / Left Thumb Impression of the Volunteer Date:

Signature and Name of witness Date:

ஒப்புதல் படிவம்

பெயர் :

வயது :

பாலினம் :

முகவரி :

அரசு கோவை மருத்துவக் கல்லூரியில் கண் மருத்துவத் துறையில் பட்ட மேற்படிப்பு பயிலும் மாணவி **மரு.ஸ்வேதா.க** அவர்கள் மேற்கொள்ளும் கண் ஆய்வில், கண் நோயின் (டெரிஜியம்) காரணங்கள் பற்றிய ஆய்வில் செய்முறை மற்றும் அனைத்து விளக்கங்களையும் கேட்டுக் கொண்டு, எனது சந்தேகங்களை தெரிவுபடுத்திக் கொண்டேன் என்பதை தெரிவித்துக் கொள்கிறேன்.

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

இந்த ஆய்வில் என்னைப் பற்றிய அனைத்து விவரங்கள் பாதுகாக்கப்படுவதுடன், இதன் முடிவுகள் ஆய்விதழில் வெளியிடப்படுவதில் ஆட்சேபனை இல்லை என்பதை தெரிவித்துக் கொள்கிறேன். எந்த நேரத்திலும் இந்த ஆய்வில் இருந்து நான் விலகிக் கொள்ள எனக்கு உரிமை உண்டு என்பதையும் அறிவேன்.

இடம் :

தேதி : கையொப்பம் /

ரேகை

SN	AGE	SEX	OCC	O/I	R/U	AL	CO	SH	SY	D/H	SM	UCVA		ASTIG	UL/BL	PTERYGIUM			TBUT		SCHIRMER		DRY	CATARACT	
												RE	LE			TYPE	STAGE	NS/TEM	RE	LE	RE	LE		RE	LE
1	55	F	ML	OD	RU	LO	GR	7	30	NIL	NO	6\60	6\18	WTR	BL	RE	4	NS	15	16	21	20	NO	SIMC	SIMC
2	60	F	HW	ID	RU	HI	IR	3	30	H	NO	6\18	6\12	WTR	UL	IN	3	NS	9	8	7	9	YES	SIMC	SIMC
3	58	F	ML	OD	RU	LO	DV	6	30	DH	NO	6\36	6\24	WTR	BL	RE	3	NS	14	15	25	20	NO	SIMC	SIMC
4	50	F	ML	OD	RU	LO	IR	9	27	DH	NO	6\60	6\36	OBL	BL	FL	3	NS	16	17	16	18	NO	SIMC	SIMC
5	45	F	TS	OD	RU	HI	GR	8	20	NIL	NO	6\9	6\6	WTR	BL	RE	3	NS	16	16	18	17	NO	EARLY	EARLY
6	57	F	TS	OD	RU	HI	DV	6	30	NIL	NO	6\60	6\60	NONE	BL	RE	2	NS	18	18	19	19	NO	SIMC	SIMC
7	75	M	FM	OD	RU	LO	DV	8	45	NIL	YES	4\60	6\36	WTR	BL	RE	3	NS	17	17	17	20	NO	SIMC	IOL
8	35	M	PO	OD	UR	LO	IR	5	16	NIL	YES	6\6	6\6	NONE	UL	IN	2	NS	8	7	8	8	YES	CLEAR	CLEAR
9	27	M	HW	ID	UR	LO	DV	2	8	H	YES	6\12	6\12	OBL	UL	RE	3	NS	7	6	8	7	YES	CLEAR	CLEAR
10	48	M	ML	OD	RU	LO	IR	8	30	NIL	YES	6\12	6\9	AGR	BL	IN	3	TEM	20	21	22	20	NO	EARLY	EARLY
11	67	F	ML	OD	RU	LO	GR	9	30	H	NO	3\60	4\60	WTR	BL	IN	4	NS	7	8	6	7	YES	SIMC	SIMC
12	32	M	CC	OD	RU	LO	DV	5	10	NIL	YES	6\12	6\12	WTR	BL	IN	3	NS	9	9	8	8	YES	CLEAR	CLEAR
13	63	M	PNR	OD	UR	LO	DV	8	20	D	YES	6\60	6\36	AGR	BL	FL	2	NS	16	16	20	25	NO	SIMC	IOL
14	40	F	HW	ID	RU	LO	RD	1	20	NIL	NO	6\9	6\9	NONE	BL	IN	2	NS	17	17	22	16	NO	CLEAR	CLEAR
15	65	F	ML	OD	RU	HI	RD	6	40	NIL	NO	6\36	6\36	WTR	UL	RE	3	NS	16	16	25	18	NO	SIMC	IOL
16	29	F	ML	OD	RU	LO	IR	7	10	NIL	NO	6\12P	6\24	OBL	UL	RE	3	NS	18	18	16	19	NO	CLEAR	CLEAR
17	75	F	ML	OD	UR	LO	IR	8	45	NIL	NO	6\24	6\24	WTR	UL	FL	2	NS	20	20	18	20	NO	IOL	IOL
18	50	F	HW	ID	UR	LO	DV	1	30	NIL	NO	4\60	6\60	OBL	UL	IN	3	NS	23	20	19	18	NO	SIMC	SIMC
19	52	F	ML	OD	RU	LO	IR	6	30	DH	NO	6\36	6\24	WTR	BL	RE	3	NS	17	16	20	15	NO	SIMC	SIMC
20	45	F	HW	ID	RU	HI	IR	2	20	NIL	NO	6\36	6\24	OBL	BL	RE	3	NS	8	7	7	8	YES	CLEAR	CLEAR
21	33	F	COM	ID	UR	LO	IR	2	6	NIL	NO	6\6	6\6	NONE	UL	RE	2	NS	18	17	20	21	NO	CLEAR	CLEAR
22	38	F	ML	OD	RU	LO	IR	8	10	NIL	NO	6\12	6\9	WTR	UL	RE	3	NS	18	19	21	22	NO	CLEAR	CLEAR
23	63	M	ML	OD	RU	LO	DV	7	40	NIL	YES	1\60	6\60	NONE	UL	FL	3	NS	19	20	22	18	NO	SIMC	SIMC

24	55	M	ML	OD	RU	HI	DV	5	30	H	NO	6\18	6\9	AGR	BL	FL	3	NS	15	15	18	20	NO	IOL	IOL
25	63	F	HOT	ID	UR	LO	GR	0	40	H	NO	6\18	6\36	NONE	UL	RE	3	NS	9	9	6	8	YES	SIMC	SIMC
26	63	F	CW	OD	UR	LO	IR	6	30	H	NO	6\9	6\12	WTR	UL	FL	2	NS	14	16	18	18	NO	IOL	IOL
27	70	F	ML	OD	UR	HI	DV	6	50	NIL	NO	6\36	1\60	AGR	UL	FL	2	NS	13	15	20	20	NO	IOL	SMC
28	70	F	TS	OD	RU	HI	IR	3	30	H	NO	6\18	6\12	OBL	UL	IN	3	NS	6	7	5	8	YES	SIMC	SIMC
29	42	F	TS	OD	RU	LO	RD	7	20	NIL	NO	6\18	6\18	OBL	BL	IN	3	NS	15	15	15	17	NO	IOL	IOL
30	65	F	FM	OD	RU	LO	RD	7	21	NIL	NO	6\36	6\60	NONE	BL	FL	2	NS	17	18	18	20	NO	SIMC	SIMC
31	40	F	FM	OD	RU	LO	IR	6	38	H	NO	6\6	6\6	NONE	BL	RE	3	NS	16	15	20	21	NO	EARLY	EARLY
32	50	F	HW	ID	UR	LO	GR	0	33	DH	NO	6\60	6\24	OBL	UL	IN	2	NS	9	8	7	7	YES	SIMC	IOL
33	37	M	COM	ID	UR	LO	IR	1	10	NIL	YES	6\9	6\12	NONE	UL	IN	3	NS	20	21	25	20	NO	CLEAR	CLEAR
34	40	F	TS	OD	RU	HI	IR	7	21	DH	NO	6\24	6\24	WTR	UL	RE	3	NS	16	16	16	22	NO	IOL	IOL
35	55	M	ML	OD	RU	LO	GR	7	30	NIL	NO	6\60	6\24	OBL	BL	RE	3	TEM	17	16	18	25	NO	SIMC	SIMC
36	62	F	TS	OD	RU	LO	DV	8	39	NIL	NO	6\60	6\60	WTR	BL	IN	3	NS	19	18	19	16	NO	SIMC	SIMC
37	40	M	ML	OD	RU	LO	DV	8	22	DH	NO	6\18	6\18	OBL	UL	RE	3	NS	15	16	20	18	NO	CLEAR	CLEAR
38	51	F	ML	OD	RU	LO	IR	9	27	DH	NO	6\36	6\36	OBL	BL	FL	3	NS	14	15	22	19	NO	SIMC	SIMC
39	43	F	HW	ID	UR	LO	GR	1	20	NIL	NO	6\12	6\36	WTR	BL	IN	2	BOTH	13	15	25	25	NO	EARLY	EARLY
40	55	F	TS	OD	RU	HI	GR	8	30	NIL	NO	6\60	2\60	WTR	BL	RE	3	NS	17	16	16	16	NO	SIMC	SIMC
41	76	M	FM	OD	RU	LO	DV	7	50	NIL	YES	HM	6\60	NONE	BL	FL	3	NS	15	16	18	18	NO	SIMC	SIMC
42	37	M	PO	OD	UR	LO	GR	5	16	NIL	YES	6\6	6\6	NONE	UL	IN	3	NS	18	19	19	19	NO	CLEAR	CLEAR
43	27	M	CW	OD	UR	LO	IR	7	8	NIL	NO	6\6	6\6	NONE	UL	IN	2	NS	17	18	22	22	NO	CLEAR	CLEAR
44	55	M	ML	OD	RU	LO	IR	8	30	NIL	YES	6\36	6\60	AGR	BL	IN	2	NS	16	17	25	25	NO	SIMC	SIMC
45	67	F	ML	OD	RU	LO	IR	9	48	H	NO	3\60	4\60	WTR	BL	RE	3	NS	19	18	16	16	NO	SIMC	SIMC
46	37	M	WL	OD	RU	LO	IR	6	14	NIL	NO	6\12	6\12	WTR	UL	RE	3	NS	16	17	18	18	NO	CLEAR	CLEAR

47	68	M	PNR	OD	UR	HI	DV	8	20	D	YES	4\60	6\36	WTR	BL	IN	3	NS	8	7	6	7	YES	SIMC	SIMC
48	38	F	ML	OD	RU	LO	GR	7	16	D	NO	6\9	6\9	OBL	BL	IN	2	NS	15	15	21	20	NO	CLEAR	CLEAR
49	67	F	ML	OD	RU	LO	RD	7	40	D	NO	6\36	6\36	AGR	UL	IN	2	NS	13	13	17	18	NO	SIMC	IOL
50	28	F	ML	OD	RU	LO	GR	8	10	NIL	NO	6\12P	6\24	WTR	BL	RE	2	NS	11	11	16	17	NO	CLEAR	CLEAR
51	50	M	ML	OD	UR	LO	IR	9	30	NIL	NO	6\24	6\24	WTR	UL	RE	2	NS	18	18	20	21	NO	SIMC	SIMC
52	76	F	CW	OD	UR	LO	IR	9	45	NIL	NO	4\60	6\36	WTR	BL	RE	3	NS	16	16	25	21	NO	SIMC	IOL
53	56	F	ML	OD	RU	LO	IR	6	30	NIL	NO	6\12	6\9	NONE	UL	IN	1	NS	15	15	15	17	NO	IOL	IOL
54	49	F	HW	ID	RU	LO	IR	2	20	NIL	NO	6\12	6\24	NONE	BL	FL	2	NS	17	17	16	15	NO	EARLY	EARLY
55	30	F	COM	ID	UR	LO	IR	2	6	NIL	NO	6\6	6\6	NONE	BL	RE	3	NS	15	20	16	16	NO	CLEAR	CLEAR
56	35	F	ML	OD	RU	LO	IR	8	10	NIL	NO	6\9	6\9	WTR	UL	RE	3	NS	16	17	19	16	NO	CLEAR	CLEAR
57	64	M	ML	OD	RU	LO	DV	7	40	NIL	NO	6\60	6\12	OBL	UL	IN	2	NS	17	19	18	19	NO	SIMC	IOL
58	50	M	FM	OD	RU	HI	DV	5	30	H	YES	6\18	6\9	OBL	BL	RE	3	NS	15	14	17	18	NO	IOL	IOL
59	57	F	HOT	ID	UR	HI	GR	0	28	H	NO	6\18	6\36	NONE	UL	RE	3	NS	7	9	8	7	YES	SIMC	SIMC
60	58	M	CW	OD	UR	LO	IR	6	30	H	NO	6\9	6\12	WTR	UL	RE	2	NS	20	21	16	22	NO	IOL	IOL
61	73	F	ML	OD	RU	LO	DV	6	44	D	NO	6\60	HM	NONE	BL	FL	1	NS	17	16	18	25	NO	SIMC	SMC
62	65	F	TS	OD	RU	HI	GR	9	35	NIL	NO	6\24	6\36	OBL	BL	IN	3	NS	19	20	19	16	NO	IOL	SIMC
63	39	F	TS	OD	RU	HI	RD	6	15	NIL	NO	6\12	6\12	WTR	UL	RE	3	NS	20	20	20	18	NO	CLEAR	CLEAR
64	41	F	FM	OD	RU	LO	RD	7	18	NIL	NO	6\18	6\24	OBL	UL	RE	3	NS	20	20	22	19	NO	CLEAR	CLEAR
65	47	F	FM	OD	RU	HI	DV	7	20	DH	NO	6\18	1/2\60	AGR	UL	RE	4	NS	16	16	25	25	NO	SIMC	SIMC
66	55	F	HW	ID	UR	LO	GR	0	30	NIL	NO	6\6	6\6	NONE	BL	IN	2	NS	17	17	16	16	NO	CLEAR	CLEAR
67	30	F	COM	ID	UR	LO	IR	1	7	D	NO	6\12	6\9	WTR	UL	RE	2	NS	19	19	20	25	NO	CLEAR	CLEAR
68	35	F	TS	OD	RU	HI	IR	6	15	NIL	NO	6\12	6\12	OBL	UL	RE	2	NS	9	8	8	6	YES	CLEAR	CLEAR
69	67	M	BUS	ID	UR	LO	DV	0	29	NIL	YES	3\60	6\60	WTR	UL	FL	3	NS	14	15	20	20	NO	SIMC	SIMC

70	57	M	FM	OD	RU	LO	IR	7	33	NIL	YES	6\60	6\36	NONE	BL	FL	1	TEM	15	14	18	20	NO	SIMC	SIMC
71	63	F	TS	OD	UR	HI	IR	6	30	H	NO	6\9	6\12	WTR	UL	IN	1	NS	14	15	30	25	NO	SIMC	SIMC
72	44	F	ML	OD	RU	LO	IR	5	20	D	NO	6\18	6\18	AGR	UL	RE	3	NS	6	5	7	8	YES	CLEAR	CLEAR
73	49	F	TS	OD	RU	HI	DV	6	27	DH	NO	6\12	6\24	OBL	BL	RE	3	NS	18	17	20	18	NO	IOL	IOL
74	46	F	ML	OD	RU	LO	RD	8	22	D	NO	6\9	6\9	NONE	UL	IN	3	NS	17	15	21	20	NO	CLEAR	CLEAR
75	70	F	HW	ID	RU	LO	RD	0	50	NIL	NO	1\60	4\60	OBL	UL	FL	2	NS	15	16	22	20	NO	SIMC	SIMC
76	45	M	FM	OD	RU	LO	GR	6	20	NIL	NO	6\12	6\24	NONE	UL	RE	3	NS	16	14	18	20	NO	EARLY	EARLY
77	33	F	HW	ID	UR	HI	GR	0	8	D	NO	6\12	6\9	OBL	BL	IN	2	NS	14	13	19	20	NO	CLEAR	CLEAR
78	55	F	FM	OD	RU	LO	IR	6	30	D	NO	6\18	6\24	NONE	UL	FL	2	TEM	9	8	7	8	YES	SIMC	SIMC
80	47	F	TS	OD	RU	LO	IR	6	25	NIL	NO	6\18	6\12	WTR	UL	IN	3	NS	7	7	7	8	YES	SIMC	SIMC
81	51	M	TS	OD	RU	LO	GR	7	30	NIL	YES	6\60	6\18	OBL	BL	RE	3	NS	18	17	21	20	NO	SIMC	SIMC
82	78	F	ML	OD	RU	LO	IR	8	50	NIL	NO	6\18	6\12	WTR	UL	FL	2	NS	17	15	22	20	NO	IOL	IOL
83	57	M	ML	OD	RU	LO	IR	6	35	DH	NO	6\36	6\24	OBL	BL	IN	2	NS	15	15	18	16	NO	IOL	IOL
84	46	F	ML	OD	RU	LO	DV	9	27	DH	NO	6\60	6\36	OBL	BL	FL	3	NS	15	14	18	18	NO	SIMC	SIMC
85	42	F	HW	ID	UR	LO	GR	0	21	NIL	NO	6\9	6\6	WTR	BL	IN	2	BOTH	14	13	14	19	NO	EARLY	EARLY
86	54	F	TS	OD	RU	HI	DV	6	30	NIL	NO	6\60	6\36	WTR	BL	IN	3	NS	16	15	16	20	NO	SIMC	SIMC
87	73	M	ML	OD	RU	LO	DV	8	50	NIL	NO	HM	5\60	NONE	BL	FL	2	NS	9	9	9	8	YES	SIMC	SIMC
88	38	M	WL	OD	UR	LO	IR	5	16	NIL	YES	6\6	6\6	NONE	UL	IN	3	NS	17	16	19	0	NO	CLEAR	CLEAR
89	29	M	CC	OD	UR	LO	GR	6	6	NIL	NO	6\12	6\12	WTR	UL	RE	3	NS	7	9	7	8	YES	CLEAR	CLEAR
90	52	M	FM	OD	RU	LO	IR	8	30	NIL	YES	6\60	6\12	AGR	BL	IN	3	TEM	14	10	14	14	NO	SIMC	IOL
91	70	F	ML	OD	RU	LO	DV	8	45	H	NO	3\60	4\60	OBL	UL	FL	3	NS	15	14	20	20	NO	SIMC	SIMC
92	36	M	FM	OD	RU	HI	GR	9	18	D	YES	6\12	6\9	NONE	UL	IN	2	NS	11	12	12	12	NO	CLEAR	CLEAR
93	64	M	ML	OD	UR	LO	DV	8	20	D	YES	6\60	6\36	AGR	BL	FL	3	NS	17	17	18	18	NO	SIMC	SIMC

94	34	F	TS	OD	RU	HI	IR	6	15	H	YES	6\9	6\9	NONE	UL	IN	2	NS	7	8	7	8	YES	CLEAR	CLEAR
95	66	F	ML	OD	RU	LO	RD	7	40	DH	NO	6\36	6\36	WTR	UL	RE	2	NS	16	15	15	18	NO	SIMC	IOL
96	29	F	ML	OD	RU	HI	RD	6	8	D	NO	6\12P	6\24	WTR	UL	RE	3	NS	17	18	25	16	NO	CLEAR	CLEAR
97	53	F	ML	OD	UR	LO	IR	7	30	NIL	NO	6\24	6\24	WTR	UL	RE	2	BOTH	16	15	16	20	NO	SIMC	SIMC
98	75	M	HW	ID	UR	LO	RD	0	50	D	NO	CFCF	6\18	AGR	UL	RE	2	NS	18	18	20	20	NO	SIMC	IOL
99	52	F	ML	OD	RU	LO	IR	6	30	NIL	NO	6\60	6\60	WTR	UL	IN	3	NS	20	20	20	26	NO	SIMC	SIMC
100	40	F	HW	ID	RU	LO	IR	2	20	H	NO	6\6	6\6	NONE	UL	IN	2	TEM	23	23	26	25	NO	CLEAR	CLEAR
101	55	F	ML	OD	RU	LO	GR	7	30	NIL	YES	6\60	6\18	OBL	BL	RE	3	NS	17	17	23	20	NO	SIMC	SIMC
102	60	F	HW	ID	RU	LO	IR	3	30	H	NO	6\18	6\12	WTR	UL	IN	3	NS	8	9	8	6	YES	SIMC	SIMC
103	58	M	ML	OD	RU	LO	DV	6	30	DH	YES	6\36	6\24	WTR	BL	RE	3	NS	19	19	25	25	NO	SIMC	SIMC
104	50	F	ML	OD	RU	LO	IR	9	27	DH	NO	6\60	6\36	OBL	BL	FL	2	NS	16	16	20	20	NO	SIMC	SIMC
105	45	F	TS	OD	RU	LO	GR	6	20	NIL	YES	6\9	6\6	WTR	BL	RE	3	BOTH	20	20	20	18	NO	EARLY	EARLY

KEY TO MASTER CHART

F- Female

M- Male

OCC- Occupation

ML- Manual Labourer

HW- House Wife

TS- Tea Estate

FM- farmer

PO- Police

CC- coconut climber

PNR- painter

COM- Company

HOT- hotel

CW- Concrete worker

BUS- business

OD- outdoor

ID- indoor

RU- rural

UR- urban

LO- low alititude

HI- high altitude

UCVA – Uncorrected Visual Acuity

CO- Complaints

GR- growth

IR- irritation

DV- defective vision

RD- redness

SH- sun exposed hours

SY- sun exposed years

D/H- Diabetes/ hypertension

SM-Smoking

ASTIG – Astigmatism

WTR- with the rule

AGR- against the rule

OBL- oblique

UL- unilateral

BL- bilateral

FL- fleshy

IN- intermediate

RE- regressing

NS- nasal

TEM- temporal

TBUT- tear film break up time