Kerala Journal Of Ophthalmology

VOL. XXVI, ISSUE 2, JUNE 2014

The Kerala Journal of Ophthalmology is the official scientific publication of the Kerala Society of Ophthalmic Surgeons and 4 issues are published every year.

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Dear Friends,

I am really happy to note a positive response to the previous issue of KJO from colleagues and seniors alike. The field of Ophthalmology is advancing at a tremendous pace. Diseases which we thought could never be cured show promise with advancements in science and technology. Retinitis Pigmentosa (RP) is one such disorder which has been a challenge to ophthalmologists over many generations. No ophthalmologist ever believed that anything could be done for this disease during his lifetime. But things are changing. With FDA approval for Argus 2 retinal implant for patients suffering from total blindness due to RP, there is real hope. For a blind man, seeing a ray of light makes a huge difference. From being totally dependent on others, he becomes independent to a great extent as far as activities of daily living are concerned. Gene therapy is yet another form of treatment which has proved to be successful in a few hereditary retinal disorders like Lebers Congenital Amaurosis (LCA).The problem with RP is the varying pattern of inheritance and multiple mutations in different families. The mutations in RP that are known is only the tip of the iceberg with many more on the reckoning. A huge effort will have to go in to map these defects in the entire population. Cataract surgery from the extracapsular extraction days has been giving 20/20 vision to many of our patients. This has never stopped us from investing millions of dollars into research to perfect what is already there. What about diseases like RP ?As ophthalmologists and scientists, shouldn't we be more concerned about those hundreds of desperate patients who visit doctor after doctor for a glimmer of hope? I think we should invest as well as spend more time in understanding, researching and offering these patients the best we can because "TO SEE" is Gods greatest gift to mankind.

Jai KSOS
Dr Ashok Nataraj
Editor, KJO

Guest Editorial

Post Graduate Training in Ophthalmology – Current Problem

At present there are five post graduate training departments attached to Government Medical Colleges in Kerala. Some of the private Medical Colleges also have Post graduate training in Ophthalmology. Private hospitals with good infrastructure facilities are conducting DNB programmes. In Kerala nearly 50 to 60 MBBS graduates join as post graduates in Ophthalmology every year. The disparity in the quality of training provided and the requirement has to be analyzed .What are the main problems related to post graduate training in our specialty?

During training period each student should get exposure to different types of patients. Patients constitute the most important clinical material. Turnover of patient population is adequate in most of the departments but in some super specialty hospitals the patients from the concerned specialty only will be in plenty. The DNB students from such centers may not have good exposure to simple and common ocular problems. Management from such institutions should take special care to organize eye camps to tackle this problem. Exposure of students to modern ophthalmic equipments is more than adequate in most of the departments. Nearly 10 to 15 years back the Government Medical Colleges were poorly equipped in infrastructure. Routine intracapsular cryo extraction under torch light with naked eye was the common practice in those days. But now the condition has improved drastically and high quality operating microscopes, OCT, different types of lasers, FFA, etc, are available in all Government Medical Colleges. By the end of two or three years each student gets enough exposure to various ophthalmic equipments and no modification is required in this aspect.

As far as a student is concerned teaching is most important. Teaching must be scheduled in all the departments where post graduate courses are going on. A clinical discussion should be conducted under the responsibility of a senior teacher at least for one hour in all days except on Sunday. Case presentation and discussion by incorporating different varieties of patients must be included. Post graduates should get a chance to present important topics and journals and the schedule must be modified accordingly. Management should consider additional remuneration for all teachers participating in teaching programmes. Majority of the teaching staff have a busy schedule in their clinics and do not get enough time to teach. This practice will destroy future generations and it is high time that we implement reforms in the mode of functioning. Teachers should take special care in this aspect.

Another problem related to training is exposure to various ophthalmic surgeries. Even though there are no specific guidelines, surgical exposure is quite inadequate in almost all departments. More number of eye camps under National Programme for Control of Blindness must be organized to tackle these problems. Attending Wet Lab sessions organized along with major conferences and using modern surgical simulators may be useful up to an extent.

Attitude of the new generation post graduates also should be examined in detail. Even though they are getting exposure to plenty of patients, surgical equipments and other facilities most of them are not just bothered to utilize these facilities. Effort from the part of the students must be modified. Each student should closely observe all major and minor surgical procedures. They should inculcate a mind set to develop good and stable surgical hands by observing minute aspects during each procedure.

Eighty to ninety percent of post graduates in ophthalmology are females. They are very good during the training period but majority of them are not able to join for fellowship or get into active practice because of family responsibilities. My sincere advice to female post graduates is that they should go ahead with fellowship and higher studies at any cost even if it entails sacrificing family commitments if they have to. This issue is quite critical as it has a direct bearing on the number and quality of ophthalmic specialists for the future.

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Major Review

Intraocular Tuberculosis – A Review

Dr. Sharanya Abraham, DO, DNB, Dr. Jyotirmay Biswas MS, FMRF, FNAMS, FIC Path., FAICO

Tuberculosis has been declared a global emergency by the World Health Organization (WHO), as it is the single most common cause of mortality and morbidity worldwide, causing nearly 3 million deaths each year.[1] Although tuberculosis primarily affects the lungs, extrapulmonary involvement in the form of intraocular tuberculosis is not uncommon, especially in immunocompromised individuals. Although the diagnostic criteria for intraocular tuberculosis has been revised several times through the years, the clinical significance of purified protein derivative (PPD) test results, computerized tomography (CT) of the chest and molecular diagnosis is well established. Relatively newer manifestations of intraocular tuberculosis such as serpiginous-like choroiditis, neuroretinitis, subretinal abscess, and vasculitis have been described in recent years. The current review highlights the clinical spectrum, diagnostic criteria and management of intraocular tuberculosis.

1. Definition

Tuberculosis is a clinical disease caused by Mycobacterium tuberculosis and is characterized pathologically by the formation of granulomas.[2] The primary site of involvement is the lungs. Extrapulmonary involvement of the gastrointestinal tract, genitourinary tract, cardiovascular system, skin, central nervous system, and eyes, may be seen either in association with clinical pulmonary tuberculosis or in isolation.[3]

2. Global Burden

It is believed that nearly one-third of the world's population are infected with M. tuberculosis and 10% of these may develop the disease eventually. Although the geographic distribution of tuberculosis is highly varied, its presence in India is common owing to the fact that pulmonary tuberculosis is an endemic disease. The ocular manifestations however, are variable. The incidence has been reported to be 1.46 % in diagnosed cases of tuberculosis in a sanatorium.[4] The incidence of ocular tuberculosis has also been studied in those with co-existing HIV infection,[5] and was found to be 2.8%, while in the setting of patients with uveitis, the incidence was highly variable being 0.6% in independent studies from India and the US [6,7] to 7.9% in another in a Japanese population.[8] In a study by Biswas and associates, the ocular morbidity was analyzed in patients from South India with active pulmonary and extrapulmonary tuberculosis, and was found to be 1.39%.[5,9] More recently, Singh and associates have reported that nearly 30% of patients who presented to a tertiary uveitis referral centre in North India had an infective uveitis.[10] Further, two-thirds of these patients had a tubercular etiology, while one-third had other infections. The higher incidence in this study could be ascribed to the use of sensitive tests such as polymerase chain reaction (PCR) in the diagnosis of intraocular tuberculosis. A study by Wilmer Eye Institute ascribed 79% of uveitis cases to tuberculosis in 1944 but ten years later this number decreased to 22% owing to awareness of other infectious diseases and stricter criteria for diagnosis of ocular tuberculosis[11].

3. Epidemiology of Intraocular Tuberculosis

The criteria for an established diagnosis of ocular tuberculosis are not as well defined as those for systemic tuberculosis. This is responsible for the variation in reported incidence of ocular tuberculosis with time and region. The epidemic of human immunodeficiency virus (HIV) infection has had a significant impact on the global epidemiology of tuberculosis. Tuberculous infection can be acquired and spread easily in HIV infected patients.[12] Because of the high co-occurrence of these two diseases, the WHO has called for a joint action ''Two diseases-one patient,'' to deliver effective and comprehensive care targeted against both HIV infection as well as tuberculosis. A recent study from India has shown that <2% of HIV-infected patients with pulmonary tuberculosis and ocular complaints had ocular tuberculosis, although the diagnostic criteria were not clearly defined.[13]

4. Transmission

Tuberculosis is an air borne infection that spreads through droplets that contain M. tuberculosis. Resistance to infection

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and development of the disease depend on the body's innate defences. About 90% of infected persons never develop the clinical disease, remaining asymptomatic throughout their lifetimes. A positive purified protein derivative (PPD) test can identify infected patients. In about 5% of patients, the infection causes disease within the first few years of exposure. In another 5% the disease may develop several years later as a result of altered host immunity. This late-developing disease is known as reactivation of latent infection.[14]

5. Pathogenesis

It is believed that intraocular tuberculosis results from hematogenous seeding either from the primary complex or from postprimary reactivated lung lesions. Once within the ocular tissue, the bacilli may remain dormant for years before they are activated.[15] Ocular tuberculosis most often develops from postprimary reactivated lesions in those who are not HIV positive.[16]

6. Clinical Spectrum of Intraocular Tuberculosis

Clinical Features

Ocular involvement in tuberculosis was recognized as early as the 1700's, however, the first description of the disease was that by Jaeger in 1855.[17] The ability of intraocular tuberculosis to mimic other infections is due to the location of infection, the host response, and the virulence of the organism.

Table 1 – Clinical Presentation in Ocular Tuberculosis

1. Anterior uveitis	Granulomatous, nongranulomatous, iris nodules and ciliary body tuberculoma
2. Intermediate uveitis	Granulomatous, nongranulomatous with organizing exudates in the pars plana or peripheral uvea
3. Posterior and panuveitis	Choroidal tubercle, choroidal tuberculoma, subretinal abscess, serpiginous-like choroiditis
4. Retinitis and retinal vasculitis	
5. Neuroretinitis and optic neuropathy	
6. Endophthamitis and panophthalmitis	

*adapted from *Gupta V, Gupta A, Rao N. Intraocular Tuberculosis – An Update. Surv Ophthalmol 52:561-587, 2007.*

In India, several ophthalmologists believe that a variety of ocular lesions are of tubercular etiology. This assumption is based on the fact that tuberculosis has a high prevalence in the country. Further, a high proportion of patients show hypersensitivity to tubercular antigen, as well as a favourable therapeutic response to various antitubercular treatments.[18-26]

Anterior Uveitis

Tuberculosis is a common cause of acute and chronic granulomatous anterior uveitis that may be associated with iris or angle granulomas with mutton -fat keratic precipitates (KPs) and posterior synechiae[27,28] (Figure 1).The old mutton-fat KPs may become pigmented. The anterior chamber may reveal cells and flare[29] of various grades when tubercular anterior uveitis presents as mild or moderate recurrent iridocyclitis. The iris may or may not be involved in the form of multiple nodules on the surface, especially near the pupillary border or the iris root. The granuloma over the iris may occur over the surface or at the pupillary border (Koeppe nodules) or in the angle.[30] Iris bombé and displacement of the iris diaphragm towards the cornea may result in pupillary block angle closure glaucoma. Cyclitis is seen frequently in tuberculosis and is a cause for caseating granuloma. A study has shown that the presence of broad-based posterior synechiae is suggestive of a tubercular cause of uveitis and warrants specific treatment.[31] The disease may be unilateral or bilateral. In the acute, miliary form of tuberculosis, patients may present with anterior chamber inflammation associated with small grayish-yellow or reddish nodules near the iris root. In severe cases, hypopyon may be seen in association with iris lesions. Clinically, these nodules first appear as small gray elevations that, if left untreated, could grow up to 3 mm in size. Over time, the colour changes from gray to yellow, and the nodules become vascularized. The nodular excrescences of the pupillary margin have been shown

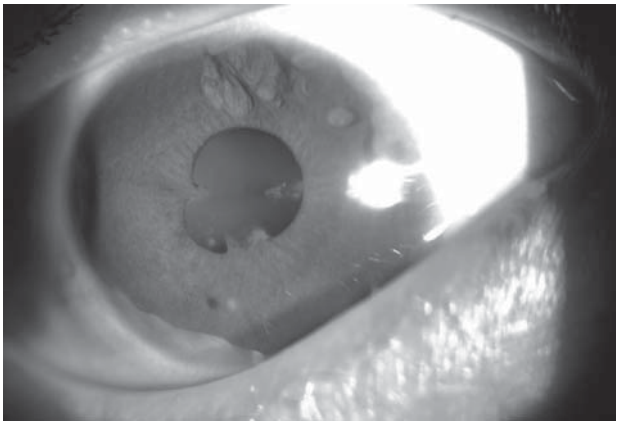


Figure 1: Granulomatous Anterior Uveitis with Mutton-fat KPs and Broad Posterior and Peripheral Anterior Synechiae

by histologic examination to be made up of a collection of epithelioid, giant cells and lymphocytes with extensive caseation. Essential iris atrophy has also been reported.

Intermediate Uveitis

Intraocular tuberculosis can simulate pars planitis and present as intermediate uveitis. Patients present with a low-grade, chronic uveitis, vitritis, snowball opacities, snow banking, peripheral vascular sheathing and retinochoroidal granuloma.[32,33] In a clinical series, it was found that in all 17 patients with intermediate uveitis, blurred vision and floaters were the presenting symptoms, while the most consistent sign in all of them was vitritis. Other signs included vitreous snowballs, peripheral retinochoroidal granuloma were additionally seen in some patients.[34]

Posterior and Panuveitis

The most common sign of posterior segment involvement is a choroidal mass, followed by choroiditis.[35-38] The possible cause is the extensive blood supply to the choroid which makes it susceptible to hematogenous spread of Mycobacterium tuberculosis. Although the assumed etiology of choroidal granulomas is hematogenous dissemination, hypersensitivity is a more likely cause of inflammation in choroiditis and vasculitis.

The ocular changes in tuberculous posterior uveitis are

a. Choroidal Tubercles

The presence of multiple choroidal tubercles suggests a hematogenous spread of tubercular bacilli. Such dissemination occurs when a caseous pulmonary lesion erodes into a blood vessel or lymphatic channel.[39] Clinically, the tubercles appear as small nodules. They may be uni- or bilateral. There are usually fewer than five tubercles but there may be as many as 50 or 60. The nodules are grayish white to yellow, with indistinct borders. Most eyes with choroidal tubercles do not develop anterior segment or vitreous inflammation. They are found mostly in the posterior pole and their size is one-fourth or less than that of the disc. There may be an overlying serous detachment. Multiple, small tubercles are seen in miliary tuberculosis.[40,41] Occasionally, a tubercle may continue to grow into a solitary mass called a tuberculoma. The choroidal tubercles may become pigmented as the infection starts to resolve. The margins become sharp and distinct; and the centre turns yellow or white with a surrounding ring of peripheral pigmentation. This process eventually results in an atrophic scar. Active choroidal tubercles usually respond well to antitubercular therapy (ATT) and generally take up to 3 to 4 months to heal. The healed lesions show atrophic areas with variable pigmentation. Histologically, tubercles involve all the layers of choroidal tissue, including the choriocapillaris, with surrounding choroidal vessels. The choroidal blood vessels are found to be obliterated. The overlying retinal pigment epithelium is normal in the early stages but is prone to disruption during later stages when the tuberculoma increases in size. The surrounding choroid is usually normal except for some lymphocytic infiltration.[42]

On fluorescein angiography, the choroidal tubercles are hypofluorescent during the dye transit but these lesions become hyperfluorescent in the late phases. Inactive healed tubercles may show only transmission hyperfluorescence.[43] Fluorescein angiography is also useful for confirming the diagnosis of choroidal neovascular membrane or retinal angiomatous proliferation that may develop in the acute phase of choroidal tubercle formation or in an inactive lesion.

b. Choroidal Tuberculoma

A large tuberculoma is a less common presentation of intraocular tuberculosis.[44] Tuberculomas may be located anywhere in the choroid; in the macula, the equator, the posterior pole or even in a juxtapapillary location. A tuberculoma may present as a large, solitary mass and may be mistaken for a tumour.[35,45] Hemorrhages and retinal folds may be seen on the surface of the tuberculoma and in later stages, the overlying retina may detach. There may also be a diffuse spread with flat growth of the tuberculoma. Rarely, a tuberculoma may present without evidence of underlying systemic disease.[46] The size of a tuberculoma is variable and it generally presents as a yellowish, subretinal mass with surrounding exudative retinal detachment.

In contrast to tubercles, large choroidal tuberculomas show early hyperfluorescence with a dilated capillary bed, progressive increase in hyperfluorescence, and a pooling of dye during the late phase, corresponding to the surrounding exudative detachment.[43] Two distinct zones have been identified on angiography, an outer zone that is hyperfluorescent over all phases and appears to be located in the peritubercular tissues and an inner initial hypofluorescent- late hyperfluorescent zone that corresponds to the tubercle. This may give rise to the characteristic “ring of fire” appearance in the early phases of the angiogram.[47]

c. Subretinal Abscess

Multiplication of bacilli in the caseous material within the granuloma leads to liquefaction necrosis and abscess formation. In those with disseminated tuberculosis, a subretinal abscess may be associated with overlying

vitreous inflammation[35,48,49] (Figure 2). These necrotizing granulomas may be seen in isolation in the eye, with no evidence of tuberculosis in other parts of the body.[50] The yellow colour of the abscess indicates ongoing liquefaction necrosis. These lesions heal well with ATT and healed lesions may show pigmentation and atrophy with a good chance of visual recovery.[51] Subretinal neovascularization may develop within the scar.[52,53] A subretinal abscess may occur in oboth immunocompromised and immunocompetent patients. Rarely, the abscess can rupture into the vitreous cavity resulting in endophthalmitis.

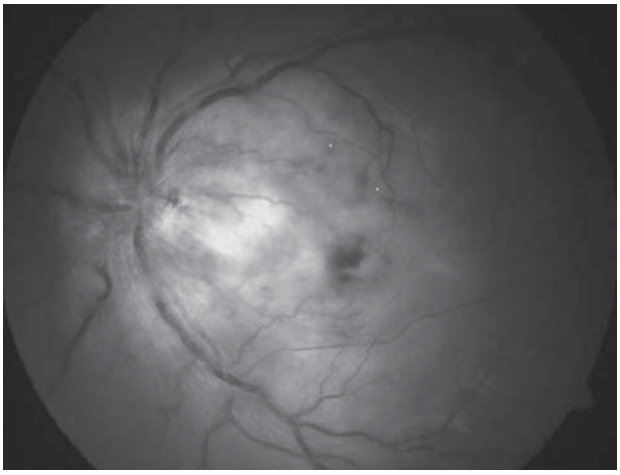


Figure 2: Subretinal Abscess

d. Serpiginous Choroiditis

Serpiginous choroiditis is a chronic, usually bilateral, recurrent inflammation that primarily involves the choroid and choriocapillaris and progresses to involve the retina secondarily. The disease is autoimmune, beginning in the peripapillary region and spreading centrifugally. Choroiditis simulating serpiginous choroiditis may be seen in intraocular tuberculous infection.[54] These tuberculous serpiginous-like choroiditis lesions reveal a relentless progression despite administration of systemic corticosteroids and immunosuppressive agents. The condition was described as early as 1932 and was called "peripapillary retinochoroiditis", although Laatikainen and Erkkila were the first to describe the association of serpiginous choroiditis with tuberculosis.[55]

Choroidal tuberculosis might present as a multifocal choroiditis that is discrete and non-contiguous at first, but that progresses relentlessly to a diffuse, contiguous variety, acquiring an active advancing edge that resembles serpiginous choroiditis. It may also present as a diffuse plaque-like choroiditis with amoeboidal spread.[54] The second eye may be affected months or years later. Presumed tubercular serpiginous-like choroiditis is classified into three morphological variants: (a) multifocal choroiditis progressing to diffuse lesions resembling serpiginous choroiditis, (b) diffuse choroiditis resembling serpiginous at initial presentation, and (c) mixed variants in which opposite eyes had features of multifocal and diffuse lesions.[56] Serpiginous choroiditis is thought to have an autoimmune mechanism, warranting multiple systemic immunosuppressive medications and alkylating agents.[57] However, presumed tubercular serpiginous-like choroiditis requires an anti-tubercular treatment strategy with the possible addition of corticosteroid. It is therefore imperative to distinguish between the two before the initiation of treatment. The origin of a patient from an area endemic for tuberculosis along with distinctive clinical features such as significant vitritis and multifocal posterior pole lesions, characteristic of serpiginous choroiditis, also serve to differentiate the two.

In diffuse serpiginous-like choroiditis, fluorescein angiography shows an initial hypofluorescent active edge with late hyperfluorescence and diffuse staining of the active advancing edge.[54] During the initial stages, when lesions are focal and active, they show an initial hypofluorescence with late hyperfluorescence. Healed lesions show transmission hyperfluorescence or blocked fluorescence due to overlying pigment epithelial proliferation.

A retrospective study in seven patients with a diagnosis of choroidal tuberculosis simulating serpiginous choroiditis showed that all patients had a strongly positive Mantoux test and positive chest radiograph results. The PCR result was positive for Mycobacterium tuberculosis in four samples of aqueous and vitreous, one was sputum positive for acid-fast bacilli, and two had histopathological evidence of tuberculosis from cervical or parahilar lymph nodes. Improvement in vision and resolution of choroidal tubercles were associated with good treatment outcomes.[54]

e. Retinitis and Retinal Vasculitis

Isolated tuberculosis of the retina is rare and is usually secondary to choroiditis.

Tubercular Retinal Vasculitis:

This is a sight threatening intraocular inflammation that affects the veins more often than the arteries. There are recent studies that show vasculitis to be a result of tuberculosis.[58,59] Patients with active vasculitis present with moderate vitritis, severe perivascular cuffing with infiltrates and extensive peripheral capillary non-perfusion areas leading to the formation of new vessels in the periphery or on the optic disc. Neuroretinitis and choroiditis patches, whether healed or active may also be seen. The diagnosis

is often presumptive as there is no confirmatory evidence of tuberculosis in these patients. The treatment includes administration of oral corticosteroids along with laser photocoagulation of the ischemic non-perfused retina under the cover of ATT. Pars plana vitrectomy may be required in those eyes with non-resolving vitreous hemorrhage.[58,59]

It remains unclear whether vasculitis in itself is infective or whether it represents a hypersensitivity response to M. tuberculosis. It is believed that the organism may persist in the ocular tissue and initiate an immune-mediated hypersensitivity response manifesting clinically as vasculitis.[60,61] The detection of the organism in intraocular fluid by PCR is significant and may be used as a guide to initiate ATT in these patients. Tubercular retinal vasculitis and Eales' disease share the common feature of extensive peripheral capillary closure. The presence of associated active or healed patches of focal choroiditis along the retinal veins aid in differentiating tuberculosis from Eales' disease and other conditions such as sickle cell retinopathy and Behçet's disease that may also be marked by capillary non-perfusion.

Eales' Disease:

Eales' disease was first described by Henry Eales, a British ophthalmologist in the 1800's. He described the disease as recurrent vitreous hemorrhage associated with headache, peripheral circulation disturbances, constipation, and epistaxis.[62] The disease affects young, healthy adult males in their third to fourth decade of life and is characterized by periphlebitis, capillary non-perfusion, neovascularization, recurrent vitreous hemorrhage, and fibrovascular proliferation in a quiet eye.[63] The disease can be classified into three stages: inflammatory, ischemic and neovascularization. The patient may be asymptomatic or have floaters and blurred vision in the early inflammatory stage. The retinal veins are inflammed and whitish exudates are seen around the veins in the peripheral retina, although on occasion, arterioles may also be involved (Figure 3). The veins become sheathed in the healed stage while choroiditis lesions are not seen in Eales' disease, and their presence may indicate tuberculosis or sarcoidosis.[59] Ischemia of the peripheral retina follows inflammation with the development of new vessels at the junction of perfused and non-perfused retina. Retinal or rarely optic disc neovascularization, recurrent vitreous hemorrhage with or without tractional retinal detachment from fibrovascular proliferation, mark the proliferative stage. Although a number of theories exist regarding the pathogenesis of Eales' disease, the most widely accepted is that of either tuberculosis or a hypersensitivity reaction to tuberculoproteins.[64]

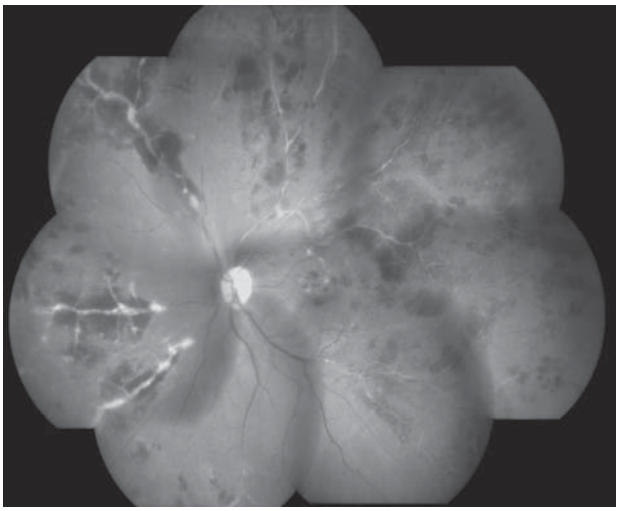


Figure 3: Eales'Disease

In India, where the disease is common, it has been reported that 1 in 135-200 patients with ophthalmic complaints present with Eales' disease.[65,66] Male predominance (97.6%) and the mean age of onset (26 years) have been reported.[67] Active perivasculitis with exudates around the retinal veins and associated with superficial retinal hemorrhages, is typically seen involving one or more quadrants. Other vascular changes include sclerosed cord of venules, irregularity of vein caliber, pigmentation along venules, kinking of venules, abnormal vascular anastomosis, and veins pulled into the vitreous cavity.[68,69,70] Macular edema and epiretinal membrane were the common changes seen at the macula. Subhyaloid hemorrhage, macular hole and submacular fibrosis, although observed were rare. Peripheral retinal neovascularization of the retina was reported in 36-84% of cases with Eales' disease.[68,69,70,71,72] Vitreous hemorrhage has been reported in 36.9% of patients leading to inability to visualize the fundus.[72] In cases where neovascularization is not detected either clinically or angiographically, vitreous hemorrhage is attributed to the rupture of capillaries or large venules during the active inflammatory stage.

The association between Eales' disease and tuberculosis has been proposed by several investigators. The pathological demonstration of tubercle bacilli in these patients has been demonstrated by Gilbert and Stock in the 1930's.[73] Studies in patients with systemic tuberculosis have shown that only 1.3 % had features of ocular tuberculosis,[65] whereas in a larger study, no cases of Eales' disease were found.[9] In a molecular biological study of vitreous samples from patients with Eales' disease, who underwent vitrectomy either for vitreous hemorrhage or retinal detachment, 41.7% showed M. tuberculosis complex DNA by PCR.[61] In another study, 11 out of 23 epiretinal membranes removed from eyes with

Eales' disease showed M. tuberculosis genome by nested PCR technique.[74] However, as culture of vitreous aspirate did not grow M. tuberculosis, it is believed that patients with Eales' disease may harbour nonviable organisms or DNA of M. tuberculosis rather than viable organisms.

Mantoux positivity is a hypersensitivity reaction to tuberculoprotein and has been reported to occur in 42-98% of Eales' disease cases in various series. In a case-control study from India, no statistically significant difference in Mantoux positivity was seen between cases and controls.[75] The fact that 67-90% of healthy adult males are Mantoux positive in India along with the presence of Eales' disease in those who are negative on testing, makes the role of tubercular hypersensitivity in Eales' disease questionable.[76] The management of active tuberculous retinal vasculitis or that associated with Eales' disease requires the use of systemic steroids and ATT to avoid reactivation of systemic disease. Sequelae such as the formation of new vessels can be appropriately treated with laser photocoagulation. Early vitrectomy with adequate endolaser photocoagulation should be considered in those with nonresolving vitreous hemorrhage associated with active fibrovascular proliferation.[77]

In retinal vasculitis, fluorescein angiography reveals staining and leakage from the vessel walls, mainly from the veins. It is important to obtain images of the peripheral retina to look for any areas of capillary nonperfusion and associated neovascularization so that timely laser photocoagulation can be instituted.

f. Neuroretinitis and Optic Neuropathy

Tuberculous neuroretinitis and optic neuropathy can arise from contiguous spread from the choroid or from disseminated hematogenous spread of the tuberculous organism from pulmonary or other primary infectious foci. The optic neuropathy is either due to a direct infection or due to hypersensitivity to the infectious agent.[78] The involvement of the nerve is in the form of an optic nerve tubercle,[79] papillitis,[80] papilledema,[80] optic neuritis,[80] retrobulbar neuritis,[81] neuroretinitis,[78] or opticochiasmatic arachnoiditis.[82] Rarely, neuroretinitis may precede the onset of exudative retinal detachment caused by tubercular multifocal choroiditis.[83] When tuberculosis causes posterior scleritis, it may result in optic nerve swelling and disc edema.

g. Endophthalmitis and Panophthalmitis

The inflammation in acute onset disease may be intense enough to produce a hypopyon, filling the anterior chamber with purulent material and involving the cornea. In the posterior segment, intense choroidal inflammation causes the formation of a subretinal abscess that may destroy the overlying Bruch's membrane. The infection and the inflammatory process then invade the retina and the vitreous. When left untreated, choroidal and subretinal abscesses can undergo liquefactive necrosis with rapid multiplication of acid-fast bacilli that can eventually burst into the vitreous cavity, presenting as endophthalmitis or panophthalmitis.[84,85]

HIV and Tuberculosis

Tuberculosis is one of the commonest opportunistic infections in AIDS patients in India.[86] In the developing world, 46% of those with HIV have a co-infection with tuberculosis, and 13% of the deaths among HIV-positive individuals are from disseminated tuberculosis.[87]

A study in an Indian population of HIV-positive patients has reported ocular tuberculosis in only 1.39% who had active pulmonary and extrapulmonary tuberculosis, suggesting that the HIV co-infection does not dramatically increase the rate of ocular tuberculosis.[88] Similar to that seen in non--HIV patients, choroidal granulomas were the most common presentation in those affected by the disease. It was also found that tuberculosis was more frequent at CD4 counts less than 300cells/μL, although the disease was present over a wide range of cell counts. Therefore, regular screening, early diagnosis, follow-up, and treatment of ocular tuberculosis in patients with AIDS are imperative irrespective of the CD4 counts.

7. Diagnosis

1. Purified Protein Derivative (PPD) / Mantoux skin test

The Mantoux skin test is most commonly ordered in suspected cases of tuberculosis. Abrahams and Schlaegel[89] found this test significant for diagnosing tubercular uveitis. Ocular hypersensitivity has been found to be directy related to cutaneous hypersensitivity.90 The standard Mantoux test consists of an intradermal injection of 5 tuberculin units (TU) of PPD to raise a wheal of 6-10 mm. The extent of induration is read at 48-72 hours. An induration of less than 5 mm is considered negative; an induration of 5-10 mm is considered positive in persons with HIV infection, in those who are in close contact with a patient with infectious tuberculosis, and in those who have healed tuberculosis lesions on chest radiograph. A test result of more than 10 mm is reported as positive for those living in high incidence areas, for employees of high risk settings (e.g., health care workers). Any result >15 mm is considered a positive result.8 Mantoux skin test results can be negative in patients with severe tuberculous infection and in very moribund

states. In addition, the dosage of tuberculo-proteins injected is important, as small doses might fail to incite a reaction.

2. Chest Radiography and Computerized Tomography
Although ocular tuberculosis can occur without evidence of systemic disease, a chest X-ray can provide information about active, healed or reactivated pulmonary tuberculosis.

Computerized tomography (CT) of the chest is more sensitive than a radiograph and a high resolution CT (HRCT) of the chest may identify subtle parenchymal changes, not otherwise seen on a radiograph.[77] In one study, HRCT chest was found to be a useful tool in the diagnosis of granulomatous uveitis, especially that related to tuberculosis, and can aid in therapeutic decision-making.[91]

It has been shown that in QuantiFERON-positive patients with severe forms of uveitis, such as serpiginous choroiditis and occlusive retinal vasculitis,[18] F-fluorodeoxyglucose positron emission tomography/CT (18F-FDG-PET/CT) is useful to identify lesions appropriate for biopsy and to establish the diagnosis and appropriate treatment for presumed tuberculosis-induced intraocular inflammation.[92]

3. Serodiagnosis
ELISA using purified cord factor as the antigen, was found to be useful in the diagnosis of ocular tuberculosis by Sakai and associates.[93] Serodiagnosis, however, is not currently the preferred diagnostic modality owing to high false positive test results and low sensitivity.

4. Interferon Gamma Release Assays (IGRA)
This test is based on the in vitro assays that measure interferon-γ released by sensitized T cells after stimulation by Mycobacterium tuberculosis antigens.[94] The newer versions of the test use antigens that are very specific to Mycobacterium tuberculosis and include early secreted antigen target (ESAT) 6, culture filtrate protein (CFP)-10, that are encoded by genes that are present in different segments of Mycobacterium tuberculosis. Two kits are available commercially: T-SPOT.TB test (Oxford Immunotec Ltd, Oxford, UK) and the QuantiFERON -TB GOLD (QFT-G: Cellestis Ltd, Carnegie, Australia).[95] According to updated CDC guidelines, QFT-G can be used in place of tuberculin skin test for infection control and surveillance and conversion, that is, from latent to manifest infection.[96]

In one study, a group of patients with suspected tubercular uveitis who were seen in the uveitis clinic at a tertiary referral centre were subjected to QFT-G test among other relevant blood investigations, chest X-rays and Mantoux tests. All the QFT-G positive patients were treated with ATT and systemic steroids with a favourable clinical outcome.[97] The test was found to be sensitive in terms of identifying latent tuberculosis in patients who subsequently had significantly reduced frequency of recurrences. The fact that this test is not affected, either by previous treatment with systemic steroids or immunosuppressives, makes it more sensitive than the Mantoux test. A negative QFT-G test can be used as an adjunct to appropriate and unbiased treatment in the setting of an endemic disease.[97]

5. Smear, Staining and Culture
Examination of smears of infected tissue or fluid after acid-fast staining is a rapid procedure for the diagnosis of tuberculosis. However, 10^6 organisms/ml of fluid are estimated to be required for detection on a smear.[9] Since the yield of organisms from intraocular fluids is low, direct microscopy of the smear is not of much help in diagnosing intraocular tuberculosis. The organism however, can be recovered from eyes presenting with endophthalmitis, as the yield of acid-fast bacilli is higher.[98,99]

M. tuberculosis takes 8 weeks to grow on Lowenstein-Jensen (egg-based) medium. The visible colonies are identified by Zeihl-Neelsen stain. The process is long and may not yield positive results due to inadequate sample from intraocular fluids.

6. Polymerase Chain Reaction (PCR)
PCR is a sensitive and highly specific technique that amplifies Mycobacterial DNA several-fold for easy detection. This is especially useful for intraocular fluids, because PCR can be performed with very small sample sizes. Samples can be either aqueous,[60] vitreous humor,[54] subretinal fluid,[100,101] or rarely, tissue obtained by chorioretinal biopsy.[102,103,104,105] Identification of the M. tuberculosis genome by targeting the IS 6110 and MPB64 sequences have been described (Figure 4).

Recently, it has been found that M. tuberculosis genome was present in > 50% of vitreous fluid samples with significant bacterial load, indicating that half the patients diagnosed as Eales' disease are indeed cases of tubercular vasculitis.[106]

8. Treatment

The treatment of tuberculosis by various ATT agents is complex. It is even more so in the case of drug-resistant tuberculosis. Inappropriate management can result in life-threatening consequences. It is advisable to obtain the opinion of an infectious disease expert/pulmonologist/internist and to manage the patient with the help of their

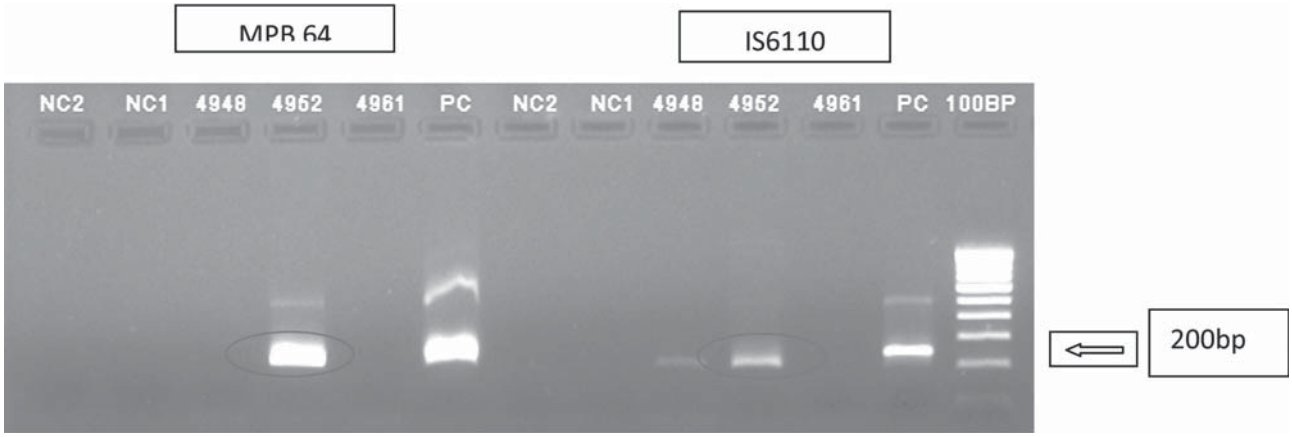


Figure 4: Agarose gel electrophoretogram representing the results of Mycobacterium tuberculosis PCR targeting MP64 gene and IS6110 region

input. Drug regimens for ocular tuberculosis are similar to those for pulmonary or extrapulmonary tuberculosis.[107] The CDC recommends the use of all four drugs (isoniazid, rifampicin, pyrazinamide, and ethambutol) for an initial 2-month period followed by a choice of different options over next 4 to 7 months.[108]

Low-dose systemic corticosteroids used for 4 to 6 weeks, along with multidrug ATT, may limit damage to ocular tissues caused from delayed type hypersensitivity. However, their use alone should be avoided without concomitant ATT as the corticosteroids may promote multiplication of bacilli, leading to panophthalmitis or they may cause a flare-up of systemic tuberculosis by activating a latent infection.[59]

Finally, numerous factors, including poor compliance, improper drug regimen, error in directing treatment or natural mutations, and often a combination of these factors may play a role in the development of drug-resistant tuberculosis. In these cases, additional agents such as rifabutin, fluoroquinolones, interferon-γ, and linezolid have been tried.

9. Conclusion

Tuberculosis is a common cause of mortality with extrapulmonary disease now constituting a greater proportion of all affected patients, especially in immunocompromised individuals. The lack of uniform diagnostic criteria for intraocular tuberculosis makes the initiation of ATT difficult. The use of PCR for detection of M. tuberculosis from intraocular fluids is now widespread. This test, along with IGRA, is extremely helpful in the management of newer manifestations of the disease. Drug regimens for ocular tuberculosis are similar to those for pulmonary or extrapulmonary disease. The development of drug resistance is a serious concern and an emerging public health issue.

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Major Review

Primary Angle Closure Glaucoma

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Glaucoma is the third most common cause of blindness and is responsible for 10% of blindness worldwide.[1] Primary open angle glaucoma (POAG; 44.7 million cases worldwide) is considered more common than primary angle closure glaucoma (PACG; 15.7 million) but the latter is more likely to cause blindness among affected persons, and thus accounts for almost half of total glaucomatous vision loss. Eighty-six percent of people with PACG are in Asia, with approximately 48.0% in China, 23.9% in India and 14.1% in southeast Asia.[2] These numbers highlight the importance of understanding the disease, its natural history, and its underlying pathophysiology, so that we may try to establish effective methods of treatment and preventive measures to delay, or even arrest, disease progression, thereby reducing visual morbidity.

CLASSIFICATION

ISGEO Classification of primary angle closure disease (PACD): Based on over a decade's attempts to develop a simplified, clinically relevant classification,[3,4,5,6] this terminology has been endorsed by the American Academy of Ophthalmology, the International society of Geography and Epidemiology of Ophthalmology (ISGEO), and the Southeast Asia Glaucoma Interest Group.

Disease entity	Clinical diagnostic criteria	
Primary angle closure suspect (PACS)	Showing >270 degrees of iridotrabecular contact PLUS absence of PAS PLUS normal IOP, disc and visual field.	OR no signs of clinical glaucoma whose angle before indentation gonioscopy is graded as Shaffer grade 2 or less, without PAS on compression. Angle is at risk
Primary angle closure (PAC)	Showing >270 degrees of iridotrabecular contact with increased IOP and/ or PAS PLUS normal disc and visual field examination.	OR angle closure demonstrating iridotrabecular contact in 75% of the angle with either PAS or increased IOP but without disc and visual field changes . The angle is abnormal in structure (PAS) or function (increased IOP)
Primary angle closure glaucoma (PACG)	Showing >270 degrees of iridotrabecular contact with increased IOP PLUS optic disc and visual field damage. Additional features may be : Corneal endothelial loss Loss of pupillary ruff Lens damage (glaucomaflecken and cataract) Iris damage(iris ischemia , chronic dilatation,unresponsive pupil, iridoschisis, ectropion uveae)	Manifesting criteria of the above and PLUS demonstrable optic nerve and visual field changes. The angle is abnormal in structure and function with optic neuropathy.

RISK FACTORS:

Various risk factors seem to be associated with PACG were:

1) Age: The risk of angle closure glaucoma increases with age.[7,8] This is thought to be due to the growing lens thickness, causing progressive shallowing of the anterior chamber.[9]

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2) Gender: Primary angle closure glaucoma with pupillary block occurs 2-3 times more commonly in females than in males.[10]

3) Refractive error: the prevalence of PACG is seen to be higher with hyperopia.[11] This was possibly thought to be because the hyperopics had shallow anterior chambers and shorter axial lengths.[12]

4) Ocular risk factors: Shallow central anterior chamber depth, thick lens, anterior lens position, small corneal diameter and radius of curvature and short axial length were considered to be the risk factors for developing primary angle closure glaucoma.[13]

Pathophysiology

Relative pupillary block was thought to be the most common mechanism of angle closure.[14] Quigley et al reviewed previous literature and also with the help of imaging devices found that when the pupil dilates, the iris typically decreases its volume by losing extracellular fluid. Eyes with angle-closure lose less iris volume with pupil dilation, contributing to obstruction of the trabecular meshwork. He also suggested that increased resistance between lens and pupil margin raises the pressure in the posterior chamber. The higher the posterior chamber pressure, the more anterior the iris position. When the resistance reaches a critical level, the peripheral iris covers the trabecular meshwork and blocks the outflow.[15]

Another possible mechanism which Quigley suggested was the plateau iris configuration leading to a raised intraocular pressure in the presence of a patent iridotomy. Plateau iris develops when the iris ciliary body junction is placed more centripetally and therefore further from the scleral spur, which leads to an anterior attachment of an iris base, in which the iris remains closer to the meshwork in a plateau configuration, even after a patent iridotomy.[15] Kumar RS et al, using a standardized ultrasound biomicroscopic criteria found plateau iris in about a third of primary angle closure suspects eyes with a patent laser iridotomy which showed that mechanisms other than pupillary block are important in Asian population.[16]

Management: Management of patients with PACD depends on the type of clinical presentation, making the diagnosis of PACS, PAC or PACG, as well as correctly identifying the underlying pathophysiology. Treatment options may be medical, laser and/or surgical.

Medical management:

Medical management has limited role in Primary angle closure disease. PACD which requires to be medically managed are those with features of acute attack or managing residual glaucoma post laser iridotomies. A patient presenting with acute attack of glaucoma requires the intraocular pressure (IOP) to be reduced aggressively, reducing the congestion in the eye for effective laser procedure to break the attack. Injection mannitol if not contraindicated is administered rapidly in a dose of 1-2 gm/kg body weight using a wide bore needle. Tablet acetazolamide 250 mg qid if the patient can tolerate otherwise tid is given orally. Topical eyedrops such as β-blockers (Timolol, Betoxolol), carbonic anhydrase inhibitors (Dorzolamide/ Brinzolamide), α2 agonist (Brimonidine) are drugs which can be used in inflamed eyes and can be used accordingly based on systemic contraindication. One must bear in mind that without reducing the intraocular pressure and the resultant corneal edema, one cannot expect topical medications to penetrate into the eye through the cornea. Associated ocular inflammation requires topical steroids the dose of which is approximately one drop 6 times a day and then slowly tapered off. Eyedrop pilocarpine 2% three times a day constricts the pupil, pulls the peripheral iris away from the angle and opens the trabecular meshwork by contraction of the ciliary muscle and tugging at the scleral spur. Although residual glaucoma following laser iridotomy can be controlled medically by a variety of medications available presently, one must not forget pilocarpine which is less expensive and in combination with timolol can be used twice a day provided systemic contraindications are considered.

Laser peripheral iridotomy:

Laser peripheral iridotomy is the current standard approach to initial treatment of primary angle closure disease. It alleviates pupillary block, which is a common underlying mechanism of PACD. Evidence indicates that laser peripheral iridotomy is probably useful in the early stages of PACG, but once extensive synechial angle closure and glaucomatous optic neuropathy have developed it is less likely to be effective in lowering IOP.[17] Argon and neodymium (Nd):yttrium-aluminum-garnet (YAG) lasers are widely used when performing laser peripheral iridotomies. A suitable combination of power and time of exposure appropriate to the iris thickness and degree of iris pigmentation is critical to produce the desired effect.[18] Sequential argon–Nd:YAG laser peripheral iridotomy is very effective, especially in thick, dark irides that are otherwise difficult to perforate with either one of the lasers alone. With this sequential technique, the total mean energy used has been reported to be as little as a third of the energy used in pure argon and Nd:YAG iridotomies.[19] The sequential technique also minimizes the incidence of iris bleeding.

Laser iridoplasty

Where mechanisms other than pupillary block exist, laser peripheral iridotomy may be insufficient in opening the anterior chamber angle. The Liwan Eye Study found residual iridotrabecular contact in 59% of Chinese eyes after successful laser peripheral iridotomy and attributed this to smaller anterior chamber angle dimensions and thicker irides.[20] In such cases, argon laser peripheral iridoplasty has been found to be effective. By applying surface photocoagulation burns in the iris, tissue contraction results in pulling of the peripheral iris away from the trabecular meshwork, thereby opening the anterior chamber angle.

Surgical Management

Surgical management is indicated where there is inadequate control of the IOP with progression of optic nerve or visual field damage despite medical and laser treatment. Other indications for early surgical management include poor compliance or intolerance to medical treatment and inability to cooperate with laser treatment.

Trabeculectomy

Trabeculectomy in angle closure glaucoma is performed similarly as for open angle glaucoma, with the exception that a surgical peripheral iridectomy should always be performed at the time of trabeculectomy in the former. In addition, the use of antimetabolites should be considered. Trabeculectomy, either alone or in combination with lens extraction, should be considered after the acute attack of angle closure, if the IOP control remains suboptimal despite laser and medical treatment, especially in more advanced cases of angle closure glaucoma which are already associated with peripheral anterior synechiae, optic nerve or visual field damage. In acutely inflamed eyes, trabeculectomy has been reported to have low success rates.[21]

Lens extraction:

Removal of the lens, especially if there is any evidence of cataract, is helpful particularly where either the lens thickness or its anterior position is thought to be the main mechanism underlying angle closure. However, if done in the acute scenario, care must be taken during surgery as these eyes are usually associated with high IOPs, shallow anterior chambers, cloudy cornea, decreased corneal endothelial cell counts, floppy iris due to previous ischemia, posterior synechiae, bulky lens, lax lens zonules, and a high risk of malignant glaucoma. Also the possibility of presbyopic correction should be explained to the patients and consent should be appropriately taken whenever contemplating such a line of action. Reports of phacoemulsification combined with goniosynechiolysis, in the presence of peripheral anterior synechial closure, have been encouraging although we do not advocate the same.[22–24] Phacotrabeculectomy with intraocular lens implantation using a twin site procedure gives excellent results in patients with coexistent glaucoma and cataract.

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Major Review

Viral Keratitis: Herpes Simplex Virus & Herpes Zoster Virus

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Ocular Herpes Simplex

Introduction

The structure of all herpes viruses includes a core of linear double stranded DNA genome surrounded by an icosahedral protein capsid, an amorphous appearing protein tegument and finally an envelope studded with viral glycoproteins. Of the 8 known Human herpes viruses, those that affect the eye include Herpes simplex virus (HSV) types 1 and 2, Varicella zoster virus (VZV), Epstein Barr virus (EBV), Cytomegalovirus (CMV), and Kaposi sarcoma associated herpes virus (KSHV/HHV-8)[1].

HSV infection is ubiquitous in humans and is the most common cause of corneal blindness in the western world. Nearly 100% of those older than 60 years of age harbour HSV in their trigeminal ganglion at autopsy[1]. With a slight male predominance, developing years after the primary infection, mean age of presentation is in the late fifth to early sixth decades. Children are at risk of binocular disease and a high recurrence rate.

Pathophysiology

The majority of ocular HSV infections are caused by HSV type 1, except in cases of neonatal infections (ophthalmia neonatorum), which are largely due to HSV-2 contracted during descent through an infected birth canal. Thus, HSV-1 mainly causes infection above the waist (face, lips and eyes) and infection occurs by direct contact of skin or mucosa with virus-laden lesions or secretions. HSV-2 gives rise to sexually transmitted infection (genital herpes).

'Primary HSV-1' infection occurs commonly in the mucocutaneous distribution of the trigeminal nerve. After the primary infection, the virus spreads from the infected epithelial cells to nearby sensory nerve endings and is transported along the nerve axon to the cell body located in the trigeminal ganglion, where it persists indefinitely in a latent state.

'Recurrence' occurs due to reactivation of the virus due to stress factors including use of steroids, exposure to UV light, immune-suppression, febrile episodes, psychological stress, trauma, surgery and hormonal fluctuation.

The following classification of herpes simplex keratitis is important for understanding this disease:

Primary ocular Herpes[1,2,3]

It is the first infection of a non immune patient. By the age of 5 years, 60 % population have been infected by HSV. The infection is subclinical in 95% and occurs in children and adolescents with flu-like symptoms, facial vesicular rash, ocular redness, pain and tearing. Signs include unilateral blepharo-conjunctivitis, vesicles on the skin of the lids (figure1) and rarely, punctuate keratitis. Healing occurs without scarring. The condition is self limiting and the usual course of the disease is 10 days. Oral antiviral therapy may speed the resolution of signs and symptoms. In immuno-compromised individuals and neonates, it may become generalised and life-threatening. All patients once infected with HSV at any site become viral carriers.

Recurrent ocular Herpes Simplex[1,2,3]

Recurrent disease can affect any level of the cornea and is unilateral. Bilateral disease is noted in immuno compromised patients. Recurrent ocular herpes may take the form of infectious epithelial keratitis, stromal keratitis, endothelitis or metaherpetic keratitis.

Infectious epithelial keratitis[1,2,3]

The earliest sign of active viral replication in the corneal epithelium is the development of small, raised, clear vesicles. Within hours, the corneal vesicles coalesce into a dendritic pattern.

Dendritic Ulcer: The most common presentation of HSV keratitis, unilateral, attributed to the presence of live virus within corneal epithelial cells. It is characterised by slender, linear, branching, ulcerating epithelial lesions with raised edges and terminal bulb formation. Swollen opaque cells laden with replicating virus line the margins of the dendritic ulcer and stain brilliantly with rose bengal. The infection lifts

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Figure 1 showing vesicles on the skin of the lids

the edges of the epithelium and hence fluorescein when applied penetrates edges of ulcer extremely quickly: strong indicator of viral infection (figure 2). Corneal hypoaesthesia is initially focal and subsequently generalised. In immune deficient patients or with the use of corticosteroids the ulcer may become large giving rise to an amoeboid appearance cases and is described as a 'geographic ulcer'.

Patients complain of foreign-body sensation, light sensitivity, redness and blurred vision. Assess for tender preauricular lymphadenopathy, systemic illness and, in infants with confirmed ophthalmia neonatorum, evaluation of the mother (± sexual partners) for evidence of HSV-2 infection.

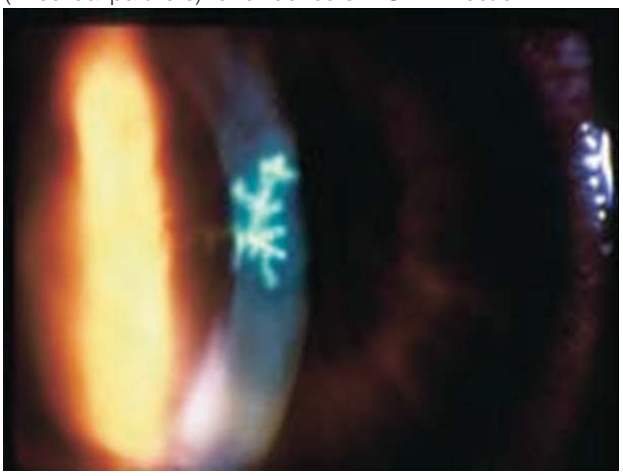


Figure 2 showing dendritic ulcer

Differential diagnosis of 'dendritiform' epithelial lesions: Other viral infections – VZV, Adenovirus, EBV; topical antivirals, beta blockers; Acanthamoeba; trophic ulcer, contact lens (CL) solutions, dry eye, trauma[1].

Stromal Keratitis[1,2,3]

Stromal disease accounts for 2% of ocular herpes and 20-48 % of recurrent ocular disease. The 2 primary forms of stromal involvement are nonnecrotizing stromal keratitis or disciform keratitis and necrotising stromal keratitis.

Non-necrotizing stromal keratitis: Majority presents with focal or multifocal infiltrates with intact epithelium. Also called 'disciform keratitis' when appearance is like a disc-shaped area of stromal oedema usually without stromal infiltration. There may be iritis and keratic precipitates. Corneal sensitivity is reduced on the affected side. There is no active microbial infection within the corneal stroma; rather, microbial antigens initiate a T-lymphocytic destruction of the stroma. Subsequent stromal vascularization and cicatrization results if untreated (figure 3).

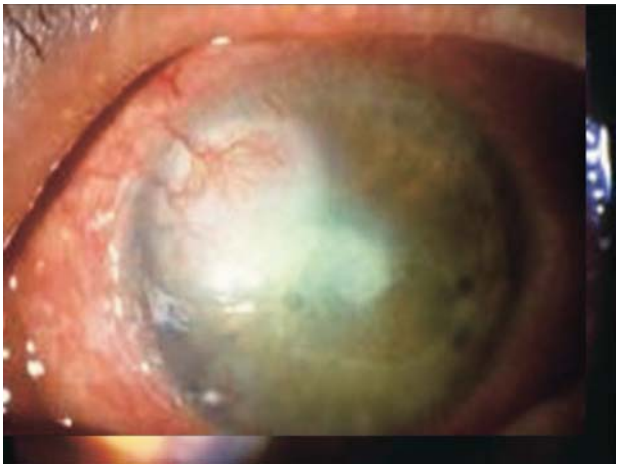


Figure 3

Necrotizing stromal keratitis: A rare, more severe form of herpetic stromal keratitis and manifests as a dense, cheesy, yellow-white stromal infiltration, ulceration, and necrosis. It results from viral replication in stromal keratocytes with a severe host inflammatory response. It mimics microbial keratitis and may lead to dense vascularisation, profound corneal thinning and perforation.

Differential diagnosis: The most common cause of active stromal keratitis is herpes simplex virus, accounting for over 70% of unilateral active cases. Sixty percent of cases of bilateral, active stromal keratitis are idiopathic in nature. Syphilis is the cause of 50% of bilateral inactive cases. Although syphilis is the leading cause of inactive, bilateral stromal keratitis, it is responsible for less than 20% of total cases.

Endotheliitis[1,2,3]

In this intriguing condition; endothelial cells are dysfunctional due to direct infection with HSV or as a consequence of anterior chamber inflammation by HSV infection. It is charecterised by a mild anterior chamber reaction with

keratic precipitates, overlying stromal and epithelial edema, and absence of stromal infiltrate or neovascularization. Patients present with pain, photophobia, and injection. Classified as disciform, diffuse or linear; the intraocular pressure may be raised.

Metaherpetic Ulceration / Neurotrophic Ulcer[1,2,3]: A 'persistent epithelial defect' oval in shape, central or paracentral in location with heaped up smooth and rounded borders in which progression may occur with corneal melting and perforation (figure 4). Causative factors include reduced tear formation, corneal hypoaesthesia and toxicity of topical antivirals.

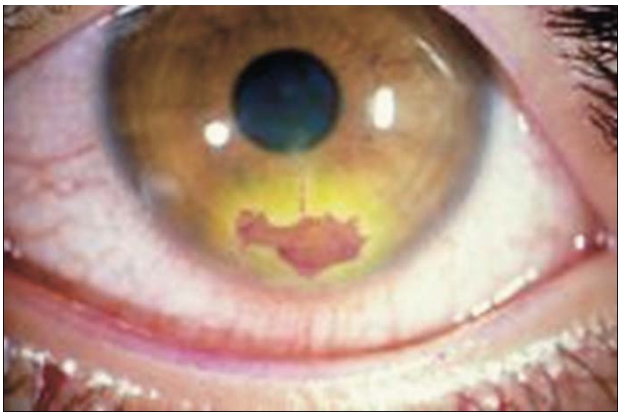


Figure 4 showing persistent epithelial defect in metaherpetic ulceration

Keratouveitis[1,2,3]: Usually a granulomatous uveitis with large keratic precipitates. Unilateral uveitis associated with high intraocular pressure is almost always caused by herpes.

Neonatal ocular HSV: This serious and 'notifiable' condition may result in conjunctivitis, epithelial or stromal keratitis, cataracts, iridocyclitis, chorioretinitis and optic neuritis.

Diagnosis: Herpes simplex virus (HSV) keratitis remains primarily a 'clinical diagnosis,' based on characteristic features of the corneal lesion. Laboratory studies help to confirm the clinical suspicion in cases lacking typical findings and in all cases of suspected neonatal herpes infection.

Laboratory Studies

Corneal smears: Giemsa/ Papanicolaou (Tzanck stain) show multinucleated giant cells(figure5), and intranuclear, eosinophillic viral inclusions. Negative cytology does not exclude HSV infection. Viral cultures obtained within several days of onset of disease and prior to antiviral therapy have a sensitivity of up to 70% and allow identification of the HSV

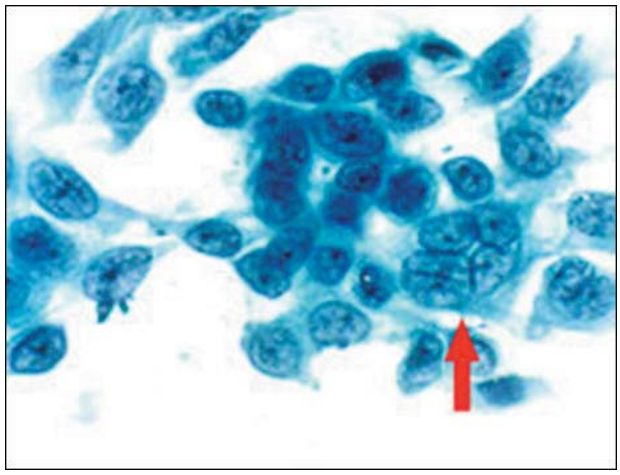


Figure 5: multinucleated giant cells in corneal smear

subtypes.

HSV-antigen detection tests, such as the enzyme- linked virus-inducible system (ELVIS), are specific, but limited by their lower sensitivity. Cell culture for confirmation of HSV is recommended when the ELVIS test result is negative.

PCR assay may detect minute load of viral DNA but does not distinguish between latent or active HSV infections.

Serologic tests may show a rising antibody titre during primary infection but are of no diagnostic assistance during recurrent episodes. There should be fourfold rise in HSV-1 IgG or the presence of IgM antibodies.
High-resolution optical coherence tomography (OCT) is a useful imaging tool in the future diagnosis of HSV keratitis.

Approach Considerations

Treatment of herpes of the eye is different based on its presentation. Epithelial keratitis is caused by live virus while stromal disease is an immune response and metaherpetic ulcer results from inability of the corneal epithelium to heal.

Epithelial Keratitis

Topical antiviral treatment with prior gentle epithelial debridement is the norm. Acyclovir 5 times a day until at least 3 days after complete healing. Options include: Ganciclovir ophthalmic gel 0.15% - 5 times daily; Trifluridine 1% drops - 9 times daily; Vidarabine 3% ointment - 5 times daily. Alpha/ beta interferons topically may be added with good results.

Most cases of HSV epithelial keratitis resolve spontaneously within 3 weeks but the rationale for treatment is to minimize stromal damage and scarring. Response to topical therapy usually occurs in 2-5 days, with complete resolution in 2 weeks. Topical therapy should be tapered rapidly after initial response and discontinued after complete healing, generally within 10-14 days. Failure of epithelial healing after

2 -3 weeks of antiviral therapy suggests epithelial toxicity, neurotrophic keratopathy, or, rarely, drug-resistant strains of HSV. Vidarabine is often effective against HSV strains that are resistant to trifluridine and acyclovir. Systemic acyclovir is preferred in patients with pre-existing ocular surface disease who are at high risk of toxicity from topical medications, immunocompromised, and pediatric patients. Topical corticosteroids are contraindicated in the presence of active epithelial keratitis.

Stromal Keratitis / Endotheliitis

Current management aims at reducing inflammatory damage with topical corticosteroids (taper 1-2 weeks) under cover of systemic antivirals (acyclovir / valacyclovir) which can penetrate intact cornea and anterior chamber. Topical cyclosporin 2% drops in an uncontrolled study showed efficacy in the treatment of stromal disease without the use of corticosteroids.

Neurotrophic keratopathy: Lubrication with preservative free artificial tears and autologous serum facilitate re–epithelialisation. Amniotic membrane grafts may be used or even a simple tarsorrhaphy may suffice. Tissue adhesives with bandage contact lenses may be utilised for descemetocole formation and impending corneal perforations.

Keratoplasty: Prophylactic oral antiviral therapy following surgery reduces recurrent ocular HSV disease, graft rejection episodes and improves graft survival. Viral reactivation induced by the grafting procedure with severing of trigeminal nerve is thought to contribute to the rejection process. It is possible for virus infection to occur in the graft.

Prognosis

Corneal epithelial disease - 50% of active lesions heal spontaneously but 95% heal with topical antiviral agents (of these, about two thirds of the eyes heal within a week and 90% by 2 weeks). Medication can be tapered after two weeks. Patients with stromal disease are more likely to develop scarring and decrease in visual acuity.

Prophylaxis

Antiviral treatment reduces the duration and severity of HSV-keratitis and helps prevent recurrence. Acyclovir 400mg twice daily for a year is recommended for patients with recurrent stromal disease or for more than 2 episodes of epithelial disease per year. Recurrence rate (and graft rejection rate) in corneal transplant patients is also reduced. Valacyclovir has superior penetration into intraocular structures and may be preferred.

Herpes Eye Disease Study [HEDS], is it relevant today?

The 'Herpetic Eye Disease Study', 1999 was a series of randomized, double-masked placebo controlled clinical trial that looked at various approaches to treat ocular HSV keratitis[1]. Issues discussed were:

Do topical corticosteroids treat stromal keratitis? Yes.
Is oral acyclovir helpful in treating stromal keratitis? No.
Is oral acyclovir helpful in treating HSV iritis?
Non-statistically significant trend favouring the use of oral acyclovir was seen.

Does oral acyclovir prevent patients with epithelial keratitis from developing stromal keratitis and iritis? No.
Does oral acyclovir prophylaxis minimize HSV recurrences? Yes, 50% less.

What triggers HSV recurrences? Psychological stress, systemic infections, sunlight exposure, menstruation, contact lens wear, injury.
No factors confirmed as triggers for recurrence.

Contrary to the study: 1.Oral antiviral therapy is currently popular as an adjunct therapy in treating epithelial disease and hastens its resolution. Patients with signs of acute ocular herpes may show symptoms of systemic inflammation, such as fever, and may benefit from oral treatment; 2. Systemic antivirals have been advocated in stromal keratitis along with topical steroids.

Herpes zoster ophthalmicus

Varicella zoster virus also known as Herpes virus III; differs clinically and antigenically from herpes simplex. Chicken pox and zoster are different entities caused by the same virus. Chicken pox represents primary infection after exposure of a non immune person to varicella zoster virus. The virus then becomes latent in the cells of dorsal root ganglion throughout the body. Reactivation may occur resulting in characteristic dermatological eruption of the herpes zoster, common in older age group[4]. Herpes Zoster in younger age indicates immune- suppression.

Commonly involves ophthalmic division of 5th cranial nerve. Reactivation is characterised by a prodrome of malaise, fever and headache which represents viremia. Hutchinson's sign describes vesicles at the side and tip of nose. It indicates ocular involvement (nasociliary branch of frontal branch of trigeminal nerve) which occurs in 50% cases and has 85% reliability that the eye will be involved[5]. The trigeminal ganglion is the most frequent site of latency for VZV; the first ophthalmic division being affected 20 times more often than the other divisions[6].

Clinical manifestations

Are variable and include punctuate epithelial keratitis

associated with follicular conjunctivitis, dendritic ulcer, coarse punctuate keratitis, anterior stromal infiltrates or nummular keratitis, kerato-uveitis, endothelitis, serpiginous ulceration, sclerokeratitis, corneal mucous plaques, disciform keratitis, neurotrophic keratopathy, exposure keratopathy and interstitial keratitis.

Pseudo dendrites are broader, more plaque like and without central ulceration. Zoster pseudodendrites are elevated, 'stuck on' mucous plaque lesions that stain with rose bengal but do not stain well with fluorescein and do not have terminal end bulbs. VZV is present in these lesions.

Nummular keratitis is a stromal reaction to soluble viral antigen diffusing into the anterior stroma/or direct viral toxicity. These lesions appear as hazy granular infiltrate just under the Bowmans membrane. They are markers of previous zoster virus inflammation.

Thus Herpes zoster is the result of reactivation of varicella zoster virus (VZV) infection. Ocular complications, which occur in up to 80% of patients with ophthalmic zoster, are secondary to both the direct effects of viral infection and nonviral mechanisms of injury, such as inflammation, occlusive vasculitis, and neuropathy[7].

Skin lesions include unilateral, vesicular skin rash that does not cross the midline and subsequently forms blisters and crusts that heal with scarring. Iritis, glaucoma, retinitis, optic neuritis, cranial nerve palsy and cranial arteritis may be seen. Post herpetic neuralgia (neuropathic pain syndrome lasting longer than 3 months after the initial rash) can develop.

Management

To prevent-severe ocular hazards and promote healing of skin lesions as the crust formation leads to severe trigeminal neuralgia. High doses of oral Acyclovir 800mg 5 times/day 10 days started within 72 hours of onset of disease and for severe cases, parenteral Acyclovir 5-10 mg/ Kg IV 8th hourly for 8-10 days. Nummular keratitis, discform keratitis and sclero keratitis respond to topical steroids. Neurotrophic keratitis is managed as in HSV. Penetrating keratoplasty has a poor success rate and hence a period of 1 year after the disease become quiescent is advised. Healthy donor tissue and systemic antiviral cover increase the rate of success. Live attenuated varicella zoster vaccine maybe used in the prevention of varicella zoster infections.

Differentiating features of eye disease caused by Herpes Simplex virus and reactivation of Varicella Zoster virus[1]: Dermatomal distribution is complete with Varicella Zoster and incomplete with Herpes Simplex. Pain is more with Varicella Zoster; skin scarring and post herpetic neuralgia occur commonly with Varicella Zoster. Dendrite in Herpes Simplex shows central ulceration with terminal bulbs; that in Varicella Zoster is smaller without central ulceration or terminal bulbs and dendritiform mucous plaques occur later. Recurrent epithelial keratitis is common with Herpes Simplex, rare with Varicella Zoster. Iris atrophy is patchy in Herpes Simplex; while it is sectoral in Varicella Zoster.

Shingles Prevention Study (SPS): The safety and efficacy of the zoster vaccine were established in the Shingles Prevention Study, a large-scale, randomized, double-blind, placebo -controlled study. The zoster vaccine is a 'live attenuated' vaccine similar in composition to the varicella vaccine but more potent, ranging from 18 700 to 60 000 plaque-forming units per dose, which is at least 14 times more concentrated than the varicella vaccine[8]. The vaccine reduced the incidence of HZO by 49% and reduced the overall severity of HZO. The incidence of post herpetic neuralgia was also reduced by 66.5%[7,8]. Efficacy of vaccine may last 6 years or more. FDA in May 2006 approved the use of the vaccine for immunocompetent patients aged 60 years and above. In March 2011, the FDA extended the approval to those aged >50years[9].

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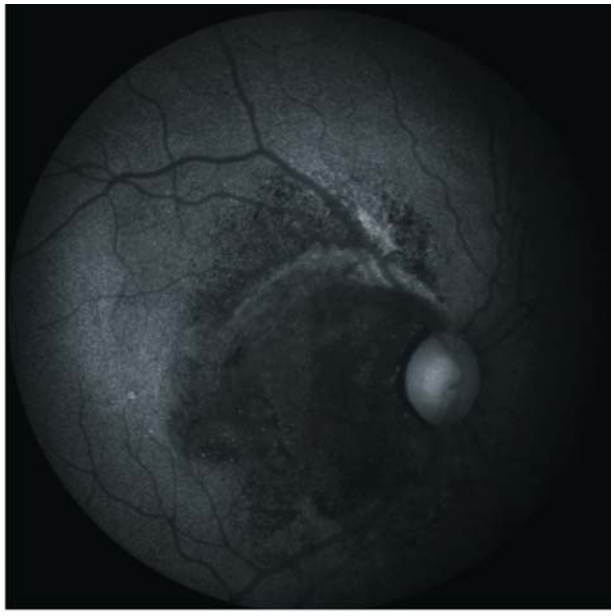
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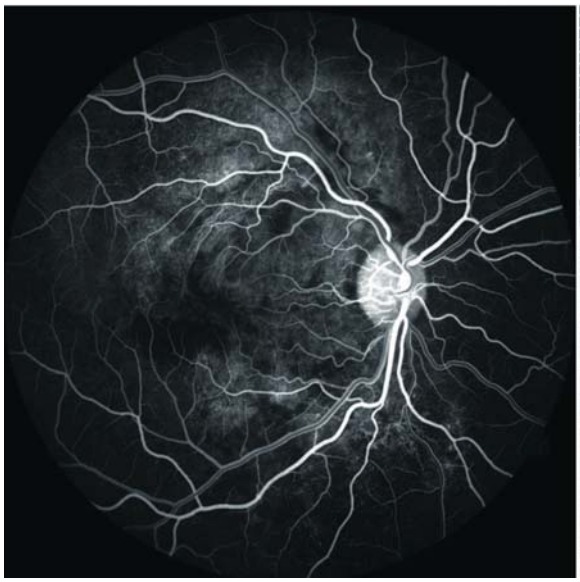
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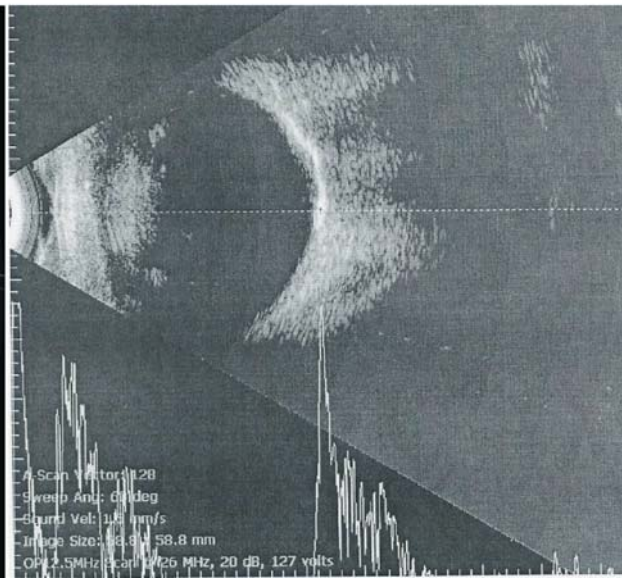
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Original Article

Quantification of Higher Order Aberrations in Children with Unilateral Amblyopia

Dr Shaji Hussain, DNB; Dr Muhemmed Swadique, DNB, FRCS; Dr. Binu Balan Parambath, DNB

Abstract

OBJECTIVES: To quantify the higher order aberrations occurring in Amblyopic eyes in our hospital.

METHOD: An ORK wavefront analyzer – COAS version 1.43.2 Hartmann-Shack aberrometer was used to measure the ocular monochromatic aberrations in amblyopic children comprising of only Strabismus, Anisometric or Strabismic Anisometropic amblyopia.

RESULT: A total of 63 Unilateral Amblyopic Children between 5-12 yrs were studied. The arithmetic mean values for the root mean square (RMS) in the amblyopic and normal eye were 0.096 and 0.073μ, respectively. This difference was statistically significant (p=0.001). The arithmetic mean values for COMA (3,-1) in the amblyopic and normal eye were 0.121 and 0.07μ respectively. This difference was statistically significant (p=0.001).

CONCLUSION: This study indicates that among the types of unilateral amblyopia there were statistically significant relation in RMS of Total HOA, COMA (3,-1), TREFOIL (3,-3) and SPHERICAL (4, 0).

Introduction

Amblyopia is defined as the best corrected VA less than 0.3 logMAR unit (ie, <40 letters, equivalent to Snellen VA <20/40) in the affected eye, not attributable to any underlying structural abnormality of the eye or visual pathway plus a difference of at least 2 logMAR lines between the 2 eyes.

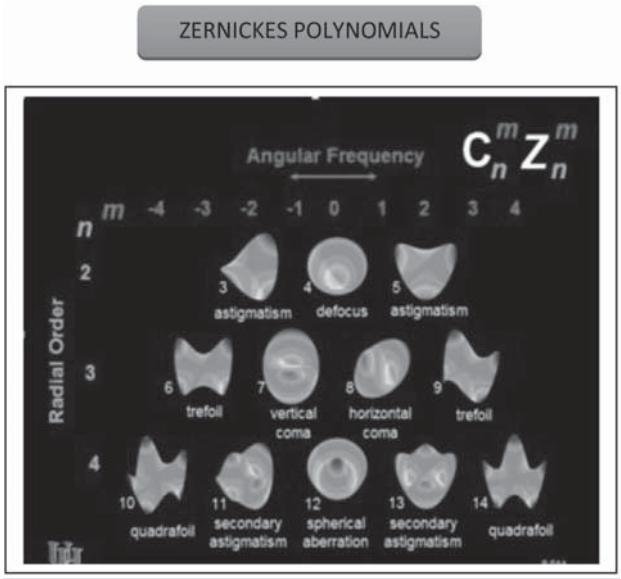
Optical aberrations occur when rays of light deviate from their desired focus point within the eye. In physical optics, light travels in waves, spreading out in all directions in a spherical pattern. The wavefront is defined as the shape of the light waves that are in phase with one another. An aberration-free optical system in an "ideal" eye has a perfect wavefront, which is described as a plane perpendicular to the line of sight. However, disturbances or aberrations of this perfect wavefront occur in normal eyes. Wavefront aberration error may be defined as the deviation of the actual wavefront from the perfect ideal wavefront in the plane of the eye's exit pupil. The local slope of the wavefront curve at the particular spot within the pupil is derived from the actual image displacement of the point source from foveola as it passes through the optical system of the eye as compared to the ideal/predicted image of the ideal optical system. It is quantified by calculating the root mean square (RMS) of the deviation.

Aberrations may be subdivided into low order aberrations, which can be corrected by sphero-cylindrical lenses, and higher order aberrations (HOA), which cannot. Major technological advances in the field of refractive surgery have led to the development of instruments that allow easy measurement of higher order aberrations. The most commonly used apparatus is based on the principles of Hartmann–Shack aberrometry, which measures distortions in a wavefront of light emitted from the eye after it has passed through the eye's optics. This aberrometer uses an optical system that images the wavefront located at the eye's entrance pupil into an array of microscopic lenslets that divide the beam of light exiting the eye into many smaller beams that are focused as tiny spots on a video sensor.

Monochromatic aberrations can be decomposed into Zernike polynomials (ZP) consisting of Zernike terms (ZT). Each term ZT of ZP corresponds to a specific geometric pattern of the aberration (eg, ZT3 = astigmatism). The number (eg, ZT3 = 0.4) next to the particular term (eg, term ZT3) describes the amount of this particular type of aberration present. Zernike terms are grouped into orders of ZP (second order ZP are terms 3, 4, 5).

These are mathematical expressions describing how much of what type of geometrical pattern (each term of ZP) is contributing to the total optical (wavefront) aberration. This can be thought of in a similar way, as any curve (function) in geometry can be mathematically approximated with a polynomial function (ie, a function y = a + bx2 +cx3 + dx4 + …).

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Email: drshajihussain@yahoo.com



Mean and Standard Deviation of RMS Total Higher Order Aberrations, RMS Coma, RMS Trefoil, RMS Spherical, RMS Secondary astigmatism and RMS Tetrafoil in Amblyopic and Normal Fellow Eyes of All Children

S NO	Type of HOA	Amblyopic Eyes (Mean ± SD)	Normal Eyes (Mean ± SD)	P*Value*
1	RMS Total HOA	0.096 ± 0.052	0.073 ± 0.041	0.0002*
2	Coma (3,-1)	0.166 ± 0.114	0.091 ± 0.059	0.001*
3	Coma (3,-1)	0.136 ± 0.084	0.116 ± 0.078	0.079
4	Trefoil (3,-3)	0.168 ± 0.134	0.101 ± 0.070	0.033*
5	Trefoil (3,-3)	0.102 ± 0.064	0.111 ± 0.084	0.67
6	Spherical (4,0)	0.110 ± 0.067	0.083 ± 0.049	0.033*
7	Secondary astigmatism (4,-2)	0.030 ± 0.021	0.035 ± 0.029	0.722
8	Secondary astigmatism (4,-2)	0.060 ± 0.040	0.048 ± 0.034	0.149
9	Tetrafoil (4,-4)	0.041 ± 0.028	0.041 ± 0.030	0.647
10	Tetrafoil (4,-4)	0.058 ± 0.042	0.082 ± 0.073	0.754

HOA = Higher Order Aberrations, RMS = Root Mean Square, SD = Standard Deviation
* Statistical significance P value < 0.05, Student's Paired t test

Methodology

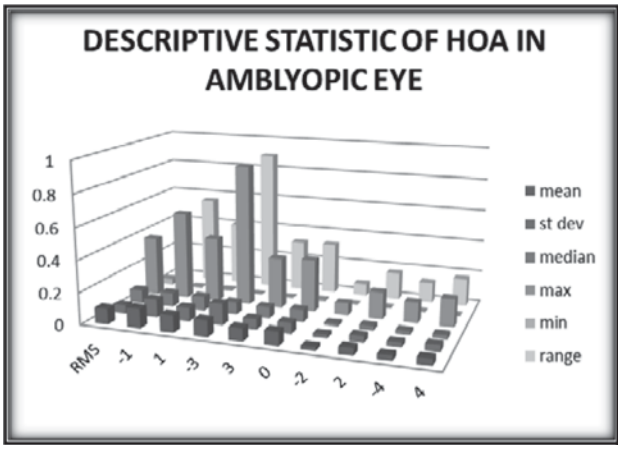
Institutional approval was granted by Thesis Review Board of Al Salama Eye Hospital,Perinthalmanna,Malappuram, for a prospective study on children attending the paediatric ophthalmology clinics at this hospital. The Aberrometric study was carried out on children between the ages of 5-12 years,with unilateral amblyopia secondary to strabismus and anisometropia were included in the study.During this one year study from August 2012 to July 2013 total of 63 Unilateral Amblyopes were reported. Fourteen of the reported cases were excluded and the remaining 49 cases were taken up for the study.

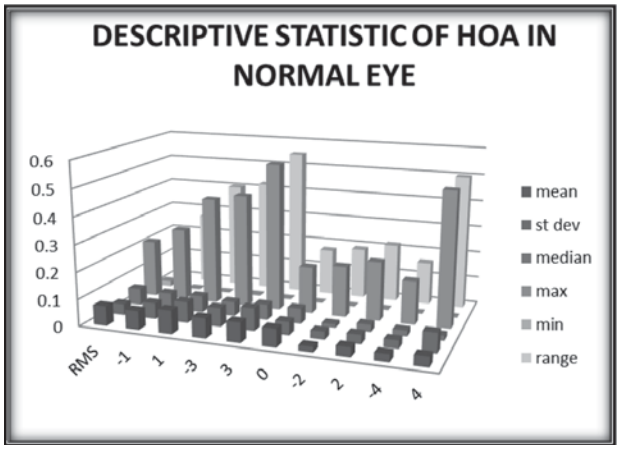
Children with bilateral or deprivation amblyopia and history of refractive or intra ocular lens surgery or who had undergone amblyopic treatment before were excluded.Children with refractive errors more than 6 D were excluded.

The best visual acuity was determined prior to testing with Snellens chart, and cycloplegic refraction after instillation of cyclopentolate 1% following which binocular vision was tested and severity of amblyopia was assessed.The child also underwent Slit-lamp and dilated fundus examination. Parental consent was obtained and an optimized refractive keratometer (ORK) wavefront analyzer – COAS version 1.43.2 Hartmann-Shack aberrometer was used to measure the ocular monochromatic aberrations with a pupil size of 5 mm. Higher order aberrations were measured using the software, Complete Ophthalmic Analysis System (COAS) version 1.43.2, working on the principal of Hartmann-Shack aberrometer (Schwind Technologies, Germeny).Higher order aberrations were analyzed by expanding the sets of Zernicke polynomials to the 4th order.

Statistical analysis was performed using the Student's paired t test. A p value of less than 0.05 was deemed statistically significant.

Results





The arithmetic mean values for the RMS in the amblyopic and normal eye were 0.096 and 0.073 μ, respectively. This difference was statistically significant (p=0.001). This was consistent with the study by Zhao PF et al [2], Yu FJ et al [5], Plech AR et al [3], L.S. Gray et al [8] but different from the study carried out by Prakash G et al [1], CaitrionaKirwan et al [6], Namrata Sharma et al, Saxena R et al in which total HOA root mean square (HORMS) values were higher in the normal fellow eye than in the amblyopic eye. The arithmetic mean values for COMA (3,-1) in the amblyopic and normal eye were 0.121 and 0.07 μ respectively. This difference was statistically significant (p=0.001). This was consistent with the study by Zhao PF et al [2], Yu FJ et al [5], Plech AR et al [3] but different from the study carried out by Prakash G et al [1] in which the 3rd order coma was 3.4 times higher in the normal eye. The arithmetic mean values for TREFOIL (3,-3) in the amblyopic and normal eye were 0.102 and 0.074 μ, respectively. This difference was statistically significant (p=0.033). This was consistent with the study by Zhao PF et al [2], L.S. Gray [8] but different from the study carried out by Prakash G et al [1] in which trefoil was 1.23 times higher in the normal eye. The arithmetic mean values for SPHERICAL (4, 0) in the amblyopic and normal eye were 0.088 and 0.67 μ respectively. This difference was statistically significant (p=0.033). This was consistent with the study by Yu FJ et al [5], but was different from the study carried out by Zhao PF et al [2], Plech AR [3], L.S. Gray [8]. Hence there were statistically significant relation in RMS of Total HOA, COMA (3,-1), TREFOIL (3,-3) and SPHERICAL (4, 0). The mean arithmetic values for the remainder polynomials showed no statistically significant difference between the amblyopic eyes and the healthy fellow eyes.

Hence third order to fourth order showed a decreasing trend which was more significant in the amblyopic eye than in healthy fellow eye, where the decreasing trend pattern was not clearly met. The main Higher Order Aberrations (HOA) was mean of Total HOA, Vertical Coma (3, -1), Vertical Trefoil (3, -3) and Spherical (4, 0) in the amblyopic eye. In this the highest percentage was shown by Vertical Coma (3,-1), 19%. Vertical coma was higher in the amblyopic eye by 1.35 times than the normal eye. Vertical coma was higher than horizontal coma by 1.12 times.

Based on the Type of Amblyopia

The arithmetic mean values for RMS of Total HOA in the amblyopic eye and normal eye in anisometropic amblyopia were 0.095 and 0.07 respectively. This difference was statistically significant (p=0.001). The arithmetic mean values for COMA (3,-1) in the amblyopic eye and normal eye in anisometropic amblyopia were 0.118 and 0.071 respectively. This difference was statistically significant (p=0.004). The arithmetic mean values for TREFOIL (3,-3) in the amblyopic eye and normal eye in anisometropic amblyopia were 0.11 and 0.076 respectively. This difference was statistically significant (p=0.03). The arithmetic mean values for SPHERICAL (4,0) in the amblyopic eye and normal eye in anisometropic amblyopia were 0.049 and 0.032 respectively. This difference was statistically significant (p=0.038). The mean arithmetic values for the remainder polynomials showed no statistically significant difference between the amblyopic eyes and the healthy fellow eyes.

		RMS		COMA(3,1)				TREFOIL(3,3)				SPHERICAL(4,0)		2º ASTIGMATISM(4,2)				TETRAFOIL(4,4)			
		A	N	A		N		A		N		A	N	A		N		A		N	
		RMS	RMS	-1	1	-1	1	-3	3	-3	3	0	0	-2	2	-2	2	-4	4	-4	4
1	mean	0.095	0.07	0.118	0.098	0.071	0.081	0.11	0.077	0.076	0.07	0.091	0.067	0.024	0.041	0.02	0.034	0.033	0.041	0.03	0.031
2	st dev	0.055	0.039	0.117	0.07	0.062	0.064	0.147	0.069	0.077	0.089	0.071	0.05	0.022	0.04	0.031	0.036	0.029	0.044	0.033	0.032
3	median	0.085	0.061	0.079	0.09	0.053	0.061	0.077	0.064	0.053	0.057	0.083	0.053	0.015	0.024	0.012	0.027	0.022	0.024	0.022	0.022
4	max	0.375	0.215	0.559	0.245	0.273	0.243	0.892	0.32	0.425	0.55	0.333	0.175	0.076	0.17	0.19	0.22	0.13	0.176	0.161	0.144
5	min	0.038	0.02	0.002	0.007	0.006	0	0	0.001	0.009	0.001	0.009	0	0.002	0.001	0	0.002	0.002	0.001	0.001	0
6	range	0.337	0.194	0.557	0.238	0.268	0.243	0.892	0.319	0.416	0.549	0.324	0.175	0.074	0.169	0.19	0.218	0.128	0.175	0.16	0.144
7	p value	0		0.004	0.223			0.03	0.706			0.038		0.517	0.409			0.651	0.138		

TABLE XI A : GROUP STATISTICS BETWEEN AMBLYOPIC AND NORMAL EYE (ANISOMETROPIC AMBLYOPIA)

Based on the Type of Amblyopia

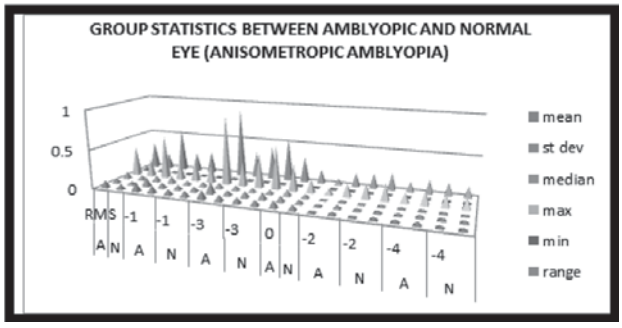
		RMS		COMA(3,1)				TREFOIL(3,3)				SPHERICAL(4,0)		2º ASTIGMATISM(4,2)				TETRAFOIL(4,4)			
		A	N	A		N		A		N		A	N	A		N		A		N	
		RMS	RMS	-1	1	-1	1	-3	3	-3	3	0	0	-2	2	-2	2	-4	4	-4	4
1	mean	0.091	0.077	0.137	0.101	0.093	0.069	0.083	0.083	0.058	0.11	0.062	0.119	0.019	0.09	0.022	0.01	0.043	0.075	0.025	0.026
2	st dev	0	0.006	0.09	0.047	0.107	0.01	0.059	0.001	0.077	0.008	0.074	0.006	0	0.041	0.009	0.01	0.028	0.065	0.007	0.008
3	median	0.091	0.077	0.137	0.101	0.093	0.069	0.083	0.083	0.058	0.11	0.062	0.119	0.019	0.09	0.022	0.01	0.043	0.075	0.025	0.026
4	max	0.092	0.081	0.2	0.134	0.168	0.076	0.124	0.083	0.112	0.115	0.114	0.123	0.019	0.119	0.028	0.017	0.063	0.121	0.03	0.031
5	min	0.091	0.072	0.073	0.067	0.017	0.062	0.041	0.082	0.003	0.104	0.009	0.114	0.019	0.061	0.015	0.003	0.023	0.029	0.02	0.02
6	range	0.001	0.009	0.127	0.067	0.151	0.014	0.083	0.001	0.109	0.011	0.105	0.009	0	0.058	0.013	0.014	0.04	0.092	0.01	0.011
7	p value	0.203		0.805	0.445			0.838	0.117			0.446		0.766	0.269			0.442	0.437		

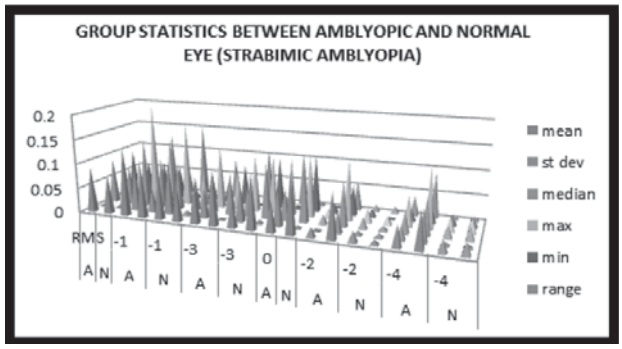
TABLE XI B: GROUP STATISTICS BETWEEN AMBLYOPIC AND NORMAL EYE (STRABISMIC AMBLYOPIA)

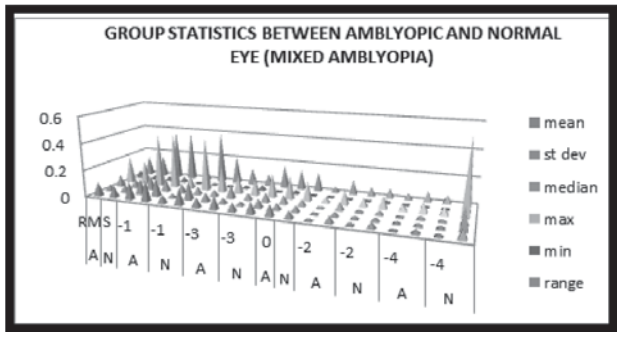
		RMS		COMA(3,1)				TREFOIL(3,3)				SPHERICAL(4,0)		2º ASTIGMATISM(4,2)				TETRAFOIL(4,4)			
		A	N	A		N		A		N		A	N	A		N		A		N	
		RMS	RMS	-1	1	-1	1	-3	3	-3	3	0	0	-2	2	-2	2	-4	4	-4	4
1	mean	0.099	0.087	0.135	0.152	0.062	0.12	0.069	0.095	0.064	0.083	0.083	0.056	0.016	0.055	0.024	0.043	0.018	0.031	0.022	0.074
2	st dev	0.045	0.054	0.118	0.136	0.031	0.133	0.068	0.042	0.03	0.066	0.049	0.046	0.014	0.034	0.022	0.026	0.018	0.024	0.021	0.172
3	median	0.084	0.067	0.105	0.094	0.067	0.059	0.052	0.105	0.055	0.075	0.07	0.05	0.012	0.059	0.024	0.031	0.013	0.027	0.017	0.014
4	max	0.199	0.18	0.402	0.411	0.095	0.403	0.208	0.142	0.128	0.175	0.17	0.141	0.043	0.108	0.069	0.091	0.049	0.08	0.063	0.5
5	min	0.059	0.026	0.031	0.037	0.001	0.014	0.003	0.02	0.037	0.007	0.024	0.001	0.002	0.003	0.001	0.021	0.002	0.002	0.001	0.002
6	range	0.14	0.154	0.371	0.374	0.094	0.389	0.205	0.122	0.091	0.168	0.146	0.14	0.041	0.105	0.068	0.07	0.047	0.078	0.062	0.498
7	p value	0.508		0.169	0.066			0.881	0.642			0.16		0.265	0.494			0.609	0.455		

TABLE XI C: GROUP STATISTICS BETWEEN AMBLYOPIC AND NORMAL EYE (MIXED AMBLYOPIA)

In the strabismic and mixed type of amblyopia there was no significant statistical difference between amblyopic and normal eye.







Conclusion

This study indicates that among the types of unilateral amblyopia reported at our hospital during the study period there were statistically significant relation in RMS of Total HOA, COMA (3,-1), TREFOIL (3,-3) and SPHERICAL (4, 0).

Recommendations

Although lower order aberrations are major factors determining the quality of the retinal image, higher order aberrations also need to be considered in amblyopic eyes as their effects are significant.

There is a great need for awareness about the importance of HOA in the treatment of non-compliant cases of amblyopia, among the ophthalmologists. To overcome this problem multiple study trials should be conducted in various hospitals and the success rates in the treatment of amblyopia should be further increased by treating HOA with wavefront guided optical lenses or wavefront laser ablation. Thus we can minimize the non-compliant cases of amblyopia and also provide good quality of life to the patients and reduce the health care cost due to amblyopia.

More research is also needed on the impact of interactions between higher order aberrations and the visual performance. Knowing which sets of zernicke terms could improve or reduce visual performance could bring new discoveries, which can clarify the current findings in studies of HOA.

More research is needed on the impact of neuroadaptability to different types of higher order aberrations in the span of time in different age groups.

Conclusion

In conclusion our findings indicate that there is significant in-between eye difference of HOA in this group of amblyopic patients. Our findings supports the hypothesis of Aberropia. Further research on the distributions of HOA in a specific group of amblyopes is necessary.

We would suggest doing this in a group of therapy resistant amblyopic patients who had a history of early discovery of amblyopia, high treatment compliance and yet a sustained amblyopia. Another interesting group to study would also be the idiopathic amblyopes. Never the less we still believe

that presence of higher order aberrations in an individual with amblyopia can disturb the visual performance in such a way that it can be clinically significant.

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Original Article

Using Purkinje Image And Capsulorhexis Marker To Improve Multifocal IOL Centration

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Abstract

Purpose: Evaluation of clinical results and IOL centration on the visual axis, by using Purkinje image and Capsulorhexis marker, as guide while performing multifocal IOL implantation.

Methods: This prospective study on 20 years of 12 patients from Aug 2012 to Jan 2013 was done by same surgeon under topical anesthesia. Patients were asked to stare at microscope light and visual axis determined by Purkinje reflex on cornea. Capsulorhexis Marker was used to mark the visual axis and size of rhexis. Rhexis was performed using corneal mark as guide. Phacoemulsification and diffractive multifocal IOL was implanted. Patients were followed for at least 3 months. Uncorrected and corrected distance, (UDVA) intermediate (UIVA) and near (UNVA) visual acuities were assessed. Any subjective complaints were recorded.

Results: Capsulorhexis was of 5-5.25 mm in size and centered on visual axis in 90% of cases. In cases where the visual axis was not centered the IOL was manually decentered to align with visual axis on Purkinje image. Uncorrected distant visual acuity was 6/9 or better in 85% of patients, UNVA was J1 in 90% of cases and UIVA was J4 in 75% of patients.Significant dysphotopsia was not complained by any. 2 patients reported haloes and glare occasionally.

Conclusion: Centering multifocal IOL on the visual axis is critical to their optimal performance. Decentration from visual axis may result if capsulorhexis is centered on dilated pupil and may result in induced astigmatism, coma, glare and haloes. This simple technique ensures optimal size of rhexis and centration of multifocal IOL on visual axis, thereby providing excellent visual outcome.

Introduction

Goal of cataract surgery has expanded beyond providing excellent snellen visual acuity to include providing best quality of vision for patients. In order to provide excellent quality of vision intraocular lenses underwent several modification including aspheric designs. Standard spherical lenses are quite tolerant to decentration and tilt, but good alignment and centration are critical factors for aspheric and multifocal lenses. For years, IOL'S were considered well centered when it is placed in the capsular bag. However many studies have shown that IOL'S may be decentered off the visual axis when placed in the capsular bag[3]. With the introduction of multifocal lens the issue of decentration has taken on greater importance. Decentration of these lenses can significantly reduce quality of vision, increase night vision symptoms, and reduce patient satisfaction. Unfortunately there has not been a consistent way to line up an IOL with the centre of patients visual axis. In this study we have evaluated the clinical results and IOL centration on visual axis, by using purkinje image[4,5] and capsulorhexis corneal marker as guide while performing multifocal IOL implantation.

Methods

This prospective non randomized study was done on 20 eyes of 12 patients from august 2012 to January 2013. Patients were considered for participation if they were between 40 and 75 years, had grade 2 to grade 4 cataract and motivated for spectacle independence. Exclusion criteria included eye diseases that could affect final visual acuity (eg : amblyopia, retinal diseases), corneal pathology, glaucoma, or astigmatism higher than 1 diopter.

Preoperative assessment included complete clinical examination , refraction and corrected distant and near vision acuity, applanation tonmetry,and indirect ophthalmoscopy. Biometry was performed by immersion method and IOL power was calculated for emmetropia.

Surgical Technique

The same surgeon performed all phacoemulsification and IOL implantation . All surgeries were done under topical anesthesia. The microscope was adjusted for coaxial illumination and patients were asked to fix on the microscope light. The first purkinje image on the anterior

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surface of the cornea and third purkinje image on anterior surface of lens were aligned and considered as visual axis. A ring shaped 5.5 mm corneal marker with central ring was used to mark the visual axis and size of the rhexis.Temporal clear corneal incision was made, OVD injected and capsulrhexis performed using corneal mark as guide. Size of the rhexis was confirmed with rhexis ruler. Phacoemulsification was done using phaco chop technique and a diffractive multifocal IOL implanted. The central ring of the multifocal IOL was aligned on the third purkinje image on IOL. Patients were followed up on day 1 , after 1 week , 3weeks and after 3 months. At 3 weeks all patients underwent uncorrected distant visual acuity (UDVA), corrected distant visual acuity (CDVA), uncorrected near visual acuity at 33 centimetres (UNVA), corrected near visual acuity (CNVA) and uncorrected intermediate visual acuity (60 centimetres) measurements. Detailed slit lamp examination was done and IOL centration on visual axis was evaluated. Patients were enquired for any subjective visual problems like glare and haloes.

Results

Mean age of the patients was 62.8 years. Of the 12 patients 8 were females and 4 were males. Eight patients underwent bilateral implantation. Uncorrected distant visual acuity was 6/ 9 or better in 85 % of eyes (17 / 20). Corrected distant visual acuity was 6 / 6 in 95 % of eyes. Uncorrected near visual acuity was N 8 or better in 90 % of eyes and uncorrected intermediate visual acuity was N 12 or better in 75 % of eyes .(Table 1) . Size of the rhexis was 5 to 5.25 mm in 95 % of eyes and centration on visual axis was seen ion 90 % of eyes. Two eyes had less than 0.5 mm decentration from visual axis. None of the patients complained of any significant dysphotopsia. However 2 patients reported of occasional haloes and glare which was not troublesome.

Discussion

In this prospective study we have evaluated the clinical results and size and centration of capsulorhexis on the visual axis. Anatomical centre of the pupil and visual axis may not be the same. Angle kappa is the angle between visual axis and pupilary axis[2]. If this axis is large (>5 degree) then a multifocal or aspheric IOL placed in the capsular bag will not be in the visual axis and result in dysphotopsias. Pukinje image on the anterior cornea and lens surface can be used as real time markers to find the visual axis. Ideal sizing and centration of capsulorhexis is a necessity in today's demanding cataract surgery. The corneal marker is a simple instrument which could be used along with the purkinje image to centre and size capsulorhexis[1]. We need a marker with 6mm internal diameter if aiming for 5.5 mm size. The main disadvantage is that corneal curvature is different between patients and so making different sizes will be difficult. During marking, corneal plane and anterior capsular plane should be parallel to avoid parallax error. Another method of capsulorhexis centration is an interface module (delta injection) system[6,7] that projects a reference ring through the microscope light source onto the anterior capsule. With the advent of femtosecond cataract surgery centration and sizing of capsulorhexis has been perfected.

Conclusion

Centering multifocal lenses on the visual axis is critical to their optimal performance.Decentration from visual axis may result if capsulorhexis is centered on dilated pupil and may result in induced astigmatism, coma, glare and haloes. This simple technique ensures optimal size of rhexis and centration of multifocal IOL on visual axis, thereby providing excellent visual outcome. Future tracking devices will probably enhance the precision by which IOL centration along the line of sight can be achieved.

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Original Article

Surgically Induced Astigmatism and Visual Outcome after 2.8 mm Incision Phacoemulsification in Patients with Cataract

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Abstract

Aim: To assess the Surgically Induced Astigmatism (SIA) and visual outcome following 2.8mm clear corneal temporal phacoemulsification.

Materials and method: A prospective study of forty eight eyes of forty two patients with cataract who underwent phacoemulsification with 2.8mm temporal incision during the time period of September 2012 to August 2013 was done. Postoperatively at one week and one month the SIA, uncorrected and best corrected visual acuity, average topographic cylinder, type of astigmatism and pattern of topography were assessed.

Results: SIA was less than 1D in 87.5% and 89.5% of the eyes at one week and one month respectively and this was statistically highly significant. The mean SIA at one week and one month were 0.55±0.48 and 0.56±0.52respectively. The average topographic cylinder at one week and one month were 0.82±0.51 and 0.79±0.52 respectively.

There was no statistical difference mean SIA or the average topographic cylinder between one week and one month post operative period. The uncorrected visual acuity (UCVA) of 6/6 was seen in 37.5% and 45.8% of the eyes and best corrected visual acuity (BCVA) of 6/6 was seen in 75% and 100% of the eyes respectively.

Conclusion: A 2.8mm clear corneal temporal phacoemulsification results in an astigmatically neutral visual outcome.

Introduction

Cataract surgery has evolved from a vision restoration procedure to a refractive surgery, free from spectacle dependence and astigmatism. Astigmatism of 0.75 dioptre is enough to cause ghosting and halos[1].

Among patients undergoing cataract surgery 15 to 20% have more than 1.50 D of astigmatism[2]. Astigmatism following cataract surgery has two components, the intrinsic preoperative astigmatism of the patient and the surgically induced astigmatism (SIA).

The intrinsic corneal astigmatism is detected by keratometry and corneal topography. Corneal topographic measurements are the current standard of care, because it not only measures corneal astigmatism but identifies irregular astigmatism also.

SIA is not determined in routine practice by the phaco-surgeon. Several factors like size, site, wound configuration, pre-existing astigmatism, laterality of the eye and patient's age could all influence the SIA. Therefore, calculating SIA will help in controlling the variability caused by these factors and SIA can be measured by comparing preoperative and postoperative keratometry values with vector and polar analysis[4].

The present study was planned to evaluate the amount of SIA after phacoemulsification with 2.8mm clear corneal temporal incisions (CCTI) in patients with less than 3D of astigmatism preoperatively.

Materials And Methods

Forty eight eyes of forty two patients with senile cataract upto LOC grade III and mild to moderate preoperative corneal astigmatism (range 0 to less than 3D) were enrolled in a prospective randomized controlled study over a period of one year. A clearance was obtained from the ethical committee and informed consent was obtained from all the patients included in the study.

Exclusion criteria included those who had congenital, developmental, traumatic and complicated cataract, those who had history of ocular surgeries in the past, any ocular pathology like corneal disease, uveitis and glaucoma, and patients on systemic steroids or immunosuppressants. Those patients who were initially included in the study but had some intraoperative complication during the surgery were also excluded.

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Clinical examinations were conducted preoperatively, one week and one month postoperatively. Preoperative examination included uncorrected and best corrected visual acuity using Snellen's chart. Slit lamp examination was done for anterior segment assessment and for grade of cataract, followed by dilated fundus examination. Intraocular pressure was recorded with applanation tonometer. Axial length was measured using IOLMaster(Carl Zeiss 500). Endothelial cell count and pachymetry were performed with a non-contact specular microscope, SP 3000P, Topcon Corporation, Fisba Optik, St Gallen, Switzerland.

Corneal astigmatism was assessed by corneal topography using the SHIN-NIPPON corneal topographer CT-1000.

To minimize inter observer variability; a single operator acquired all the topographies. The topography examination was performed by placing the subject's chin on the chin rest and the forehead rested against the forehead strap.

The subject was instructed to look at a green fixation light. Using the joystick the image of the mires were adjusted so that the pupil was centered in the centering box and focused until the machine automatically captured the eye image. Simulated keratometric values (simK) were noted and astigmatism evaluated from corneal topographic maps.

Surgical Technique

All surgeries were performed under local anesthesia. Conventional phacoemulsification using the Alcon Infinity machine with posterior chamber IOL implantation was performed by a single experienced surgeon following the standard surgical techniques. A clear corneal temporal, biplanar incision with two side port entries at 9'o and 2'o clock positions were made. A continuous curvilinear capsulorhexis and hydro dissection were performed.

Phacoemulsification of the nucleus with stop and chop technique was done followed by cortical aspiration. The anterior chamber and the capsular bag were filled with viscoelastic and a foldable IOL was inserted into the capsular bag using an injector cartridge system. The residual viscoelastic material was removed using an irrigation/aspiration hand piece. Balanced salt solution was injected to maintain the anterior chamber. All surgeries were completed without using sutures.

Post operatively, patients were followed at one week and one month making a note of the uncorrected and best corrected visual acuity and corneal topography. The preoperative and postoperative simK values were put in the SIA calculator version 3.1 to calculate the SIA based on Holladay's method of vector analysis.

Statistical Analysis

The preoperative parameters were summarized as medians and interquartile ranges with respect to ophthalmological measurements and all other variables were summarized as frequency tables. Preoperative and postoperative measurements of the required parameters were analyzed and compared using Wilcoxon signed rank tests. The final SIA (D) values were summarized as mean and standard deviation. A p-value of 0.05 was taken as statistically significant.

Observations, Results and Analysis

Baseline characteristics

Forty eight eyes of forty two patients who underwent planned phacoemulsification with capsular bag IOL implantation and who met all the required criteria were included in the study. Out of the forty two patients six had bilateral cataract. There were 14(33.3%) males and 28(66.7%) females in this study group. The mean age of these patients was 65.1 (range 45 - 85) years. There were 54.1% right eyes and 45.8% left eyes in the study group. The baseline uncorrected visual acuity (UCVA) and best corrected visual acuity (BCVA) ranged from 6/12 – 6/60. The mean spherical equivalent of spectacle correction was 1.35D and the average topographic cylinder was 0.84D± 0.53.

Postoperative outcome measures

At one week and one month postoperatively the median UCVA were 6/9(range 6/6-6/18) and 6/9(6/6-6/12) and median BCVA were 6/6 (range 6/6-6/12) and 6/6 respectively. The UCVA improved to 6/6 in 37.5% of eyes, 6/9 in 35.4%, 6/12 in 0.8% and 6/18 in 6.25% at one week postoperatively. At one month UCVA improved to 6/6 in 45.8% of eyes, 6/9 in 37.5%, and 6/12 in 16.6% and none had UCVA less than 6/12.

The BCVA improved to 6/6 in 75% of eyes, at one week post op, 6/9 in 25% and none had BCVA of 6/12 or less. At one month all the patients had BCVA of 6/6(100%).

The average topographic cylinders were 0.82D±0.51(range0.04-2.42) and 0.79±0.52(range0.02-2.06) at one week and one month postoperative respectively. On comparing preoperative average topographic astigmatism with one week and one month, a p value of 0.696 and 0.649 respectively was obtained which was statistically not significant.

The SIA at one week and one month postoperatively were 0.55D±0.48 (range0.03-2.62) and 0.56D±0.51 (range0.04-2.93) respectively. On comparing SIA at 1st week with the SIA at 1st month postoperatively, a p value of 0.962 was obtained. This difference was not statistically significant.

The table 1 shows baseline characteristics; UCVA, BCVA, average topographic cylinder and SIA at one week and one month. Table 2 shows the distribution of UCVA and BCVA at one week and one month.

	Preoperative	One week	One Month
Median UCVA	6/24 (range 6/12-6/60)	6/9 (range 6/6-6/18)	6/9 (range 6/6-6/12)
Median BCVA	6/18 (range 6/12-6/60)	6/6 (range 6/6-6/9)	6/6
Average topographic cylinder	0.84D±0.5 (0.08-2.47)	0.82±0.51 (0.04-2.42)	0.79±0.52 (0.02-2.06)
Mean SIA	-	0.55±0.48 (0.03-2.62)	0.56±0.51 (0.04-2.93)

Table 1. Preoperative baseline and postoperative Outcomes

Visual acuity	6/6	6/9	6/12	6/18
One week				
UCVA	18 (37.5%)	17 (35.4%)	10 (20.8%)	3 (6.2%)
BCVA	36 (75%)	12 (25%)	Nil	Nil
One month				
UCVA	22 (45.8%)	18 (37.5%)	8 (16.6%)	Nil
BCVA	48 (100%)	Nil	Nil	Nil

Table 2. UCVA AND BCVA at one week and one month

Distribution of SIA at one week and one month

At one week postoperatively, 60.4% of eyes had SIA below 0.5D, 27.1% had SIA between 0.5-1D, 8.3% had SIA between 1-1.5D and 4.1% had SIA of more than 1.5D. At 1st month postoperative 60.4% of eyes had SIA of less than 0.5D, 29.1% had SIA between 0.5-1D, 6.2% had SIA between 1-1.5D and 4.1% had SIA of more than 1.5. (Fig 1)

Distribution of type of astigmatism

Preoperatively 25% of eyes were astigmatically neutral, 29.1% had against the rule astigmatism (ATR), 18.7% had with the rule (WTR), and 27.1% had oblique astigmatism.

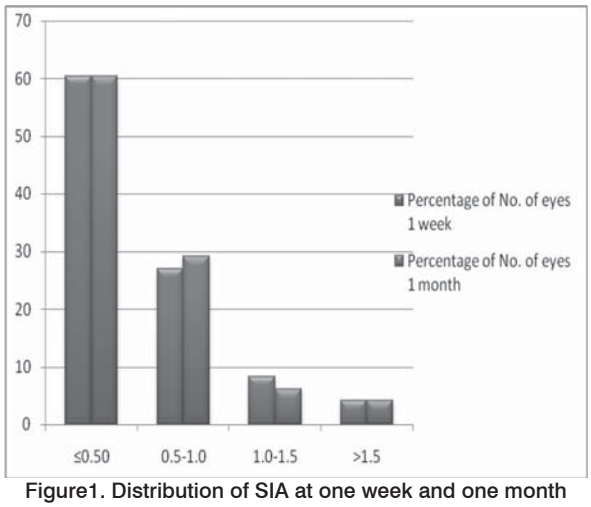


Figure1. Distribution of SIA at one week and one month postoperatively

At one week 27.1% of eyes were astigmatically neutral, 22.9% had ATR, 29.1% had WTR, and 20.8% had oblique astigmatism. At one month 31.2% of eyes were astigmatically neutral, 20.8% had ATR, 29.1% had WTR and 18.7% had oblique astigmatism. (Table 3)

Type	preop	1 week	1month
ATR	14 (29.1%)	11 (22.9%)	10 (20.8%)
WTR	9 (18.7%)	14 (29.1%)	14 (29.1%)
NIL	12 (25%)	13 (27.1%)	15 (31.2%)
OBLIQUE	13 (27.1%)	10 (20.8%)	9 (18.7%)

Table 3. Type Of Astigmatism

Distribution of pattern of astigmatism

Preoperatively 60.4% of eyes had round pattern, 16.6% had oval, 12.5% had symmetric bow-tie and 10.4% had asymmetric bow-tie. At one week 47.9% of eyes had round, 25% had oval, 18.7% had symmetric bow-tie and 8.3% had asymmetric bow-tie. At one month 43.7% of eyes had round, 27.1% had oval, 18.7% had symmetric bow-tie and 10.4% had asymmetric bow-tie. (Table 4).

Pattern	Preoperatively	1 week	1 month
Round	29 (60.4%)	23 (47.9%)	21 (43.7%)
Oval	8 (16.6%)	12 (25%)	13 (27.1%)
Symmetric bow-tie	6 (12.5%)	9 (18.7%)	9 (18.7%)
Asymmetric bow-tie	5 (10.4%)	4 (8.3%)	5 (10.4%)

Table 4. Pattern of astigmatism by topography

The mean spherical equivalent of the refractive error at one month was 0.34D. Forty Six percent of the eyes had plano spectacle correction, 43.7% had less than 1D refractive error.

Discussion

The aim of modern cataract surgery is to achieve optimum uncorrected visual acuity. Preoperative or the surgically induced astigmatism can limit the postoperative uncorrected visual acuity. Modern small incision, sutureless, clear corneal surgery has improved surgical outcomes as compared to the older techniques.

Studies have shown that incisions of less than 3.00 mm in size did not cause flattening of cornea more than 0.25 D[5].

It has been well documented that CCTI induce least astigmatism. Recent studies indicate that a small 2.8mm CCTI induces little refractive change in eyes especially with low preoperative astigmatism regardless of incision site. There are only five studies available on the outcome of 2.8mm CCTI in literature [7,8, 9,10]. Morcillo-Laiz[10] found no statistically significant difference between the 2.8 mm and 2.2mm incisions.

The temporal approach has the advantage that it is a comfortable position for the surgeon to operate, provides better exposure to surgical field, better visualization of the intraocular structures and easier for patient to fixate eye ball towards the light of microscope, when operating under topical anaesthesia[11].

The main outcome measures of our study included corneal astigmatism and SIA, UCVA and BCVA.

The mean SIA was 0.55D and 0.56D at one week and one month postoperatively. The magnitude of SIA by vector analysis is reported to be around 0.44D to 0.88D in temporal clear corneal incisions[10].

The SIA is found to increase as the incision size increases. The distribution of SIA in the present study was less than 1D in 87.5% of the patients. This was statistically significant.

The average topographic cylinder in our study did not show significant change from baseline at one week but reduced to 0.79 at one month postoperative from baseline of 0.84. The change was not statistically significant (p= 0.649). In the study done by Kohnen et al[12] the astigmatism changes in temporal incision of different sizes; 3.5 mm and 4.00 mm and 5.00 mm were evaluated. The mean astigmatism at 1st postoperative week was found to be 0.86 D in 3.5 mm incision group, 0.93 D in 4.00 mm group and 1.6 D in 5 mm incision group. In our study the mean astigmatism at 1st week post op was 0.82D.The mean astigmatism was lesser in our study as compared to Kohnen et el. This could be due to the smaller incision of 2.8mm used in our study as compared to all the three incision size used by Kohnen et al.

On analyzing the preoperative astigmatism and its change postoperatively 31.2% of eyes had no astigmatism at one month as compared to 25% of eyes at the beginning of the study. There was a slight increase in WTR astigmatism from 18.7% preoperatively to 29.1% postoperatively and decrease in ATR astigmatism from 29.1% to 20.8%. This was not statistically significant(p 0.776). As per many studies superior incision causes a shift to ATR astigmatism and temporal incision causes a shift to WTR astigmatism[13,14,15]. In our study the shift to WTR is present but not significant statistically.

The mean refractive and topographic cylinders at one month were 0.47 and 0.79 respectively. Coefficient of correlation ('r') between refractive and topographic cylinder at 1st month was 0.388, which shows only a weak correlation between the two.

We found that out of the total forty eight eyes, 72.9% and 83.3% had UCVA of 6\9-6\6 at one week and one month respectively. This was highly significant. 75% of the patients had BCVA of 6/6 at one week and 100% had BCVA of 6/6 at one month. The BCVA stabilized in 75% of patients at one week. This correlates with the study done by Edwards et al[16]. He has shown in his study that patients can be given refractive prescription at their one week postoperative visit following sutureless phacoemulsification.

The mean spherical equivalent at one month postoperatively is 0.34D which is negligible showing that majority of patients had plano to minimal spectacle correction of less than 1D.

Bogan et al have described a classification scheme of the morphological patterns observed in corneal topography maps obtained from normal subjects[17]; this classification scheme was used in our study. The topographic pattern remained normal in all patients postoperatively. None of them had irregular pattern suggestive of astigmatism. The incision used in the study did not create any significant changes in the corneal shape.

Conclusion

We found that at the end of one month the UCVA and BCVA improved to 6/6 in 45.8% and 100% of patients respectively with a minimal SIA as compared to other studies. The vision and SIA stabilized by one week and there was no much change in the pattern of astigmatism. It has been reported in several other studies that a temporal incision causes a

WTR shift in axis, but we did not find this shift significant in our study.

Our study corroborates the finding that 2.8mm CCTI can be used in mild to moderate astigmatism as a routine procedure in a high volume surgical set up.

To have an optimum postoperative refractive outcome, the SIA should be analyzed. It will help the surgeon to modify the surgical technique by changing the incision site, size and configuration of the wound.

Corneal topography is an essential tool in the preoperative evaluation of the patient for cataract surgery.

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Original Article

Analysis of Clinicopathologic Correlation in Ocular Surface Squamous Neoplasms

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Abstract

Aim: To describe the clinical and histologic characteristics of ocular surface squamous neoplasia (OSSN) lesions and provide clinicopathologic correlation to determine the clinical features that predict higher grade lesions.

Materials and Methods: Retrospective interventional case series of 15 eyes of 15 consecutive patients with histopathological diagnosis of OSSN during the time period of 22 months from July 2011 to April 2013. The details included age, sex,duration,laterality and history of smoking. Complete ophthalmic evaluation was done and type and extent of lesion documented.The pathology was analysed by a single experienced ocular pathologist. The lesions were classified as dysplasias (mild,moderate,severe) and squamous cell carcinomas. Patients who presented after primary treatment were excluded. The clinical features were compared with the pathologic grades and the correlation was analysed.

Results: The mean age was 54.33 years (23-85 years). Males (86.7%) outnumbered females (13.3%) in study. 33.3% of specimens were characterized as mild or moderate dysplasias ; 26.7% as carcinoma in situ; and 40% as squamous cell carcinoma.There were 8 smokers of which 7 had high grade lesions.Duration of symptoms ranged from 1 month to 1 year.The temporal conjunctiva was involved in 8(53.3%) patients and 6(40%) had nasal location.75% of temporal lesions had a high grade pathology.Leukoplakic type was most common(66.7%).Out of 4 papillomatous lesions,3(75%) showed higher grade pathology.

Conclusions: Male gender,smoking, involvement of temporal conjunctiva,papillomatous lesion were associated with higher-grade histologic lesions. These findings may help clinicians to evaluate the lesions more accurately and anticipate the pathologic grade of ocular lesions suspected to be OSSN. This aids in treatment planning and assessing the prognosis.

Introduction

Ocular surface squamous neoplasia (OSSN) is a spectrum of corneal or conjunctival epithelial neoplasias that range from mild dysplasia to squamous cell carcinoma. Lee and Hirst[1] have proposed this term in the year 1995. Histologically the neoplastic cells are characterized by hyper chromatic atypical nuclei, scanty cytoplasm and mitotic figures. The severity of the disease is classified according to the thickness of the epithelium that is involved[2]. Mild dysplasia is characterized by the involvement of $<1/3$ of the epithelium whereas in moderate dysplasia there is involvement of 1/3 to 2/3 of epithelial thickness. Full thickness involvement is characteristic of severe dysplasia. Severe dysplasia is difficult to differentiate from carcinoma in situ(CIS).In dysplasias and carcinoma in situ the basement membrane is intact. Squamous cell carcinoma (SCC) occurred when atypical cells have fenestrated the epithelial basement membrane and spread into the conjunctival stroma.

There are several studies that describe the various clinical features of OSSN lesions from various countries. Accordingly, the lesions are predominant in Caucasians ranging from 90 – 100%. OSSN is more common in older age group with a predilection for males[1-3]. It can develop in younger age group also, especially in association with immuno deficiency and xeroderma pigmentosum[6]. The main risk factors are thought to be exposure to ultraviolet B (UV-B) radiation[5,7], cigarette smoking3, fair skin and light pigmentation, area close to the equator (latitude <300 from the equator), xeroderma pigmentosum , viral infections like Human Immunodeficiency Virus (HIV) and Human Papilloma Virus (HPV)[4,6].

In the study, we describe the clinical and histological characteristics of OSSN and provide clinicopathologic correlation to determine the clinical features that predict higher grade lesions .

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Materials and methods

The study was a retrospective interventional case series of 15 eyes of 15 patients who were diagnosed pathologically with conjunctival squamous dysplasia, carcinoma in situ or SCC during the time period of 22 months from July 2011 to April 2013.

The details included age, gender,laterality, history of smoking, presence of any viral infections and history of any previous biopsy. The patients presented after the initial surgery and those with predominant corneal involvement were excluded from the study. Complete ophthalmic evaluation was done in all cases. In cases where a suspicion of fixity to the underlying structures, Ultrasound Biomicroscopy was done to detect any scleral involvement. All suspected lesions underwent excisional biopsy with frozen section in large lesions. The specimens were fixed in 10% buffered formalin and transported to the pathology lab.

The clinical factors evaluated included location, size and extent of the lesion. Regarding the location, the predominant quadrant that is involved by the lesion was taken for the analysis. The type of the lesion was noted and documented as papillomatous, leukoplakic or nodular. Leukoplakic lesions are diffuse lesion with a tuft of blood vessels whereas papillomatous variety is an exophytic growth characterized by the papillary growth pattern on the surface. Nodular lesions are rapidly growing lesions with well defined borders. The pathology was analyzed by a single experienced ocular pathologist. The lesions were classified as dysplasia (mild, moderate, severe) and squamous cell carcinoma. Severe dysplasia was included as carcinoma in situ for analysis purpose. The clinical features were compared with the pathologic grades and the correlation was analyzed.

Statistical Analysis

All statistical analysis was performed using the Statistical Package for the Social Sciences version 16.0 (SPSS). To evaluate which clinical and pathological features were associated with increasing histological grade, a chi square analysis was performed for categorical variables using the linear -by-linear association P value output because of the ordinal nature of the dependent variables. For continuous variables, non parametric Kruskal Wallis test was performed.

Results

The mean age group was 54.33 years ranging from 23 – 85 years. There were 13(86.7%) males and 2(18.31%) females.

Table 1:Frequency of various clinical features

Clinical feature	Frequency (%)
Presenting symptom	
Growth	14(93.3%)
Irritation/Foreign Body Sensation	1(6.7%)
Smoking	
Yes	8(53.3%)
No	7(46.7%)
Location	
Inferior	1(6.7%)
Nasal	6(40%)
Temporal	8(53.3%)
Superior	0(0%)
Type	
Leukoplakic	10 (66.7%)
Nodular	1 (6.7%)
Papillomatous	4 (26.7%)

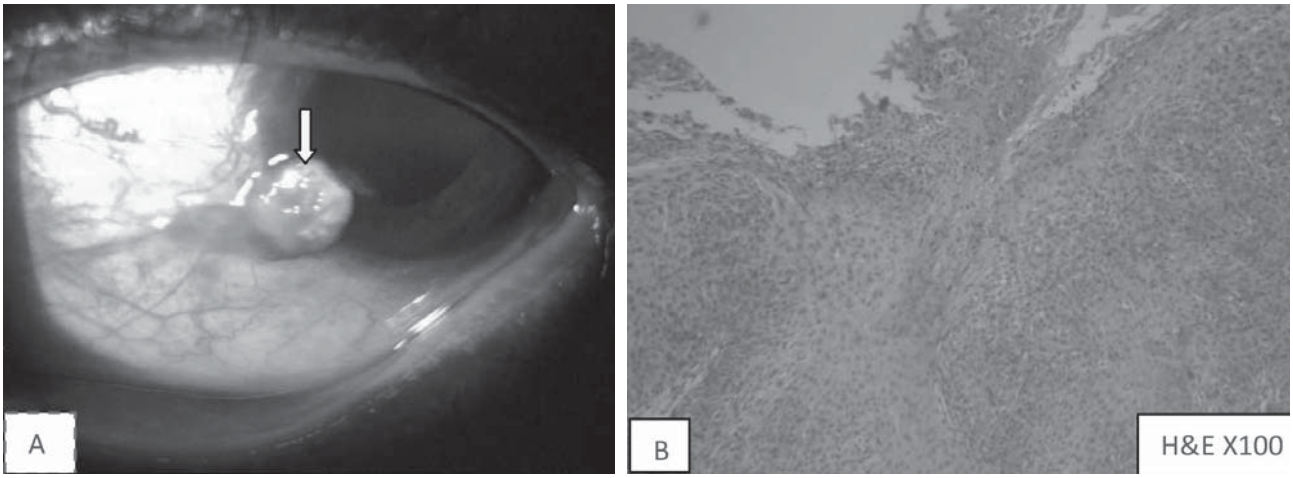


Fig A.Leukoplakic lesion with surface keratinisation (arrow)and prominent blood vessel involving the limbus Fig B Invasive Squamous cell carcinoma-invasion of stroma is seen as tumour nests and broad expansive tumour masses

Right eye was involved in 7(46.7%) patients and left eye involvemt was seen in 8 (53.3%) patients. The history of smoking was present in 53.3% of patients. Majority of patients (93.3%) presented as a growth in the eye where as one patient (6.7%) presented with redness and foreign body sensation. The duration of symptoms ranged from 1-12 months with a mean of 2.63±2.9 months. The temporal conjunctiva was involved in 53.3% (n=8)of cases whereas nasal location was seen in 6 cases (40%). One patient showed inferior conjunctival involvement. None of the lesions were seen in the superior conjunctiva. (Table 1) The type of the lesion was leukoplakic in 10 patients (66.71%) where as nodular and papillomatous variety seen in 6.7% and 26.7% respectively. HIV positivity was seen in one patient.

Of the 15 lesions, SCC was seen in 6 cases (40%), CIS in 4 (26.7%) ,moderate dysplasia in 2 (13.3%) and mild dysplasia in 3 (20%) cases(Table 2).

Table 2:Distribution of Pathology in the study group

Pathologic Grade	Frequency(%)
Squamous cell Carcinoma (SCC)	6 (40%)
Carcinoma In Situ(CIS)	4 (26.7%)
Moderate Dysplasia	2(13.3%)
Mild Dysplasia	3 (20%)

Comparison between clinical features and pathological grades and the statistical correlation was given in Table 3. Out of 13 male patients 10 patients (77%) had higher grade lesion where as both the females had low grade lesions. Among smokers 7(87.5%) had higher grade lesions. Temporal location had more chance of high grade pathology (75%) compared to the other areas. Of the six lesions on nasal side, 3 were of low grade and 3 were of high grade. The patient with inferior location had squamous cell carcinoma and he was seropositive for HIV. 60 % of leukoplakic lesions were higher grade where as among papillomatous growth 75% were of higher grade. 71.4% of patients having symptoms for <1 month had higher -grade histology.

Table 3: Comparison between clinical features,pathological grades & statistical correlation

Variable	Mild dysplasia	Moderate	CIS	SCC	P value
Sex					
Male(n=13)	15.4% (2)	7.6%(1)	30.8 %(4)	46.2%(6)	
Female(n=2)	50%(1)	50%(1)	0%	0%	0.15
Age	15.37±3.22	49±11.31	52.25±19.65	53.33±16.98	0.62
Smoking					
No(7)	13.3%(2)	13.3%(2)	13.3%(2)	6.7%(1)	
Yes 8	12.5 %(1)	0%	25%(2)	62.5%(5)	0.21
Type					
Leukoplakic (10)	20%(2)	20%(2)	30%(3)	30%(3)	
Nodular(1)	0%	0%	100%(1)	0%	
Papillomatous(4)	25%(1)	0%	0%	75%(3)	0.52
Location					
Superior (0)	0%	0%	0%	0%	
Temporal(8)	25%(2)	0	37.5%(3)	37.5%(3)	
Inferior(1)	0%	0%	0%	100%(1)	
Nasal(6)	16.7%(1)	33.3%(2)	16.7%(1)	33.3%(2)	0.69

According to Chi-square fisher exact test ,there is no statistical association for pathology with sex,laterality, symptom, location and type. Large P values from Kruskall Wallis test for continuous variables like age ,duration of symptoms also indicates a statistically insignificant association with outcome variable.

Discussion

The uniqueness of our study is that it compares the pathological characteristics with clinical features. Male gender, smoking ,temporal bulbar conjunctival involvement and papillomatous lesion are definitely associated with the higher grade lesions.

As already described in other studies[1-4], our study also found out that OSSN occurs mostly in men. Males do more outdoor activities than females and so the chances of UV-B exposure is high. Since we have not quantified the amount of UV-B exposure, this can be speculative also.

In OSSN, the majority of the lesions are located in the interpalpebral area either nasal or temporal quadrant. The reason being described are more sun exposure and the peculiarity of the limbus. Limbus is a transitional zone between the conjunctival and the corneal epithelium. Tsengs concept of long living and high proliferation rate of stem cells in the limbal area along with alteration in this anatomical area influenced by other factors can cause abnormal maturation of conjunctival and corneal epithelium resulting in the formation of OSSN. In our study, the temporal conjunctiva was the most common site of involvement followed by nasal and inferior. Temporal area receives more sunlight compared to the nasal conjunctiva as the nasal side is partly studded by the nose leading to less UV-B exposure[10]. Most of the temporal lesions showed high grade histopathology which may also be explained by the above stated reasons. None of our cases showed superior conjunctival involvement as it is well covered by the upper lid. Eventhough inferior conjunctiva is covered by lid ,in our study the patient with inferior lesion was seropositive for HIV and he had squamous cell carcinoma in histopathology.Apart from interpalpebral area,other areas may also get involved if other risk factors are present.

The clinical appearance of OSSN lesion also had a correlation with the pathologic grade. Andrew A. Kao et al noted nodular and papillomatous had higher grade histopathology in their study[8].But leukoplakic and papillomatous lesions showed higher grade in our study.The higher grade pathology in leukoplakic lesions could be associated with the increased surface area[9] whereas papillomatous lesions are having an association with human papilloma virus which has got a strong association with OSSN. However, to prove this association it needs various immunological tests and it needs further research also.

There were several limitations to our study. Because of the small sample size, some relevant factors did not achieve statistical significance. A larger prospective study in being planned to look more specifically into the other risk factors.

Conclusion

In conclusion, male gender,smoking,temporal conjunctival involvement ,papillomatous and leukoplakic variant are associated with the high grade lesions. These findings are helpful in anticipating the pathologic grade of ocular lesions suspected to be OSSN which in turn aids in planning the treatment and assessing the prognosis. Future studies are needed to understand the pathogenesis of OSSN and the role of various carcinogens specifically HPV and HIV in varied manifestations of the disease process and their role in prognosis of disease. Multicentric studies with long term follow up is needed to look at the treatment outcomes and the rate of recurrence and its correlation to the clinicopathological gradings.

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Original Article

Choroidal Thickness by Enhanced Depth Imaging Optical Coherence Tomography in Type 2 Diabetes

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Abstract

Purpose: To investigate the changes in macular choroidal thickness in eyes with various stages of diabetic retinopathy, and changes after focal laser using enhanced depth imaging Optical Coherence Tomography (EDI OCT).

Materials And Methods: Seventy one consecutive diabetics were recruited from the retina clinic between February 2013 and may 2013.All patients underwent a complete ophthalmologic examination, including EDI OCT, refractive error ,duration of diabetes, retinal status as part of their routine clinical work-up.Inclusion criteria were age >18 years, diagnosis of diabetes type 2. Exclusion criteria were refractive error of more than -5 diopters (D) in the study eye, a history of retinal photocoagulation or any other treatment for diabetic retinopathy; previous ocular surgery; proliferative diabetic retinopathy; or vitreoretinal diseases. Patients were divided into 3 groups, those who presented with no diabetic retinopathy (nonproliferative diabetic retinopathy (NO NPDR), with diabetic retinopathy (nonproliferative diabetic retinopathy[NPDR] and no clinically significant macular edema CSME(-); or with NDPR and clinically significant macular edema CSME(+). Forty five age and sex-matched healthy subjects (54 eyes) (control group) without risk factors for diabetes were also included in the study. EDI OCT was performed by CIRRUS HD OCT. Statistical calculations were performed using statistical software (Statistical Package for Social Sciences version 17.0; SPSS, Inc., Inc,Chicago, IL).

Results: The mean subfoveal choroidal thickness was significantly reduced in each diabetic group compared with the control group ($P < 0.001$). Similarly, the mean choroidal thickness was significantly reduced in NPDR CSME(-) at inferior and nasal ETDRS sector compared with the control group, while mean choroidal thickness was significantly reduced in all the sectors in NPDR/CSME(+) group.

Conclusions: In our study we found that there was a reduction of choroidal thickness in each diabetic group (NPDR/CSME-, and NPDR/CSME+) compared with the control group (age- and sex-matched healthy subjects). The choroidal thickness value at the fovea decreased further in the presence of macular edema (NPDR/CSME+versus NPDR/CSME-).

Aim Of The Study

To investigate the changes in macular choroidal thickness in eyes with various stages of diabetic retinopathy, and changes after focal laser using enhanced depth imaging optical coherence tomography (EDI OCT).

Materials And Methods

Seventy one consecutive diabetics were recruited from the retina clinic between February 2013 and May 2013. All patients underwent a complete ophthalmologic examination, including EDI OCT, as part of their routine clinical work-up. In all subjects, refractive error, duration of diabetes, was recorded on clinical charts. Retinal status was evaluated by slit lamp fundus biomicroscopy after pupil dilation. Inclusion criteria were age >18 years, diagnosis of diabetes type 2. Exclusion criteria were refractive error of more than -5 diopters (D) in the study eye, and a history of retinal photocoagulation or any other treatment for diabetic retinopathy; previous ocular surgery; proliferative diabetic retinopathy; signs of any other active retinal disease in the study eye such as age related macular degeneration AMD; Choroidal Neovascularization (CNV); or Vitreoretinal diseases (i.e., Vitreomacular Traction Syndrome and Epiretinal Membrane). The diabetic eyes were graded according to the ETDRS scale. Patients were divided into 3 groups, those who presented with no diabetic retinopathy (Nonproliferative Diabetic Retinopathy [NO NPDR]), with Diabetic Retinopathy (Nonproliferative Diabetic Retinopathy [NPDR] and no clinically significant macular edema CSME(-); or with NDPR and clinically significant macular edema CSME(+).Forty five age- and sex-matched healthy subjects (54 eyes) (control group) without risk factors for diabetes were also included in the study. EDI OCT was performed by CIRRUS HD OCT. 22eyes of 11 patients underwent focal laser. They were followed up at 4 wks. Two 6-mm high-quality line scans through the fovea (one horizontal and one vertical) were obtained for each eye. The line scans were saved for analysis after 100 frames were averaged, using the automatic averaging and eye tracking

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features of the proprietary device. The choroidal thickness was measured from the outer portion of the hyper reflective line corresponding to the RPE to the hypo reflective line or margin corresponding to the sclerochoroidal interface. These measurements were made of the subfoveal choroid and at 1500-μm interval from the fovea to nasal, temporal, superior and inferior from the center of the fovea (five ETDRS sectors). Statistical calculations were performed using statistical software (Statistical Package for Social Sciences version 17.0; SPSS, Inc., Inc,Chicago, IL). The difference between healthy subjects (control group) and each diabetic group was generated by conducting repeated measures ANOVA followed by Dunnet's post-hoc test for each individual axial choroidal thickness over the horizontal and vertical line scans (at 1500-μm interval from the fovea to nasal, temporal, superior, and inferior from the center of the fovea). Correlation between BCVA, CMT, and choroidal thickness at the fovea in each diabetic group was analyzed using the Pearson's correlation coefficient. The chosen level of statistical significance was $P < 0.05$

Result

Patient Demographics and Clinical Characteristics A total of 118 eyes of 71 consecutive diabetic patients were included in the study group.58 female [49%] 61 males (51%). The NO NPDR group contained 10 eyes of 10 patients. 4 males(40%) & 6 females(60%). The NPDR CSME- group contained 56 eyes of 36 patients. 28 females (50%) & 28 males (50%). NPDR CSME+ group contained 54 eyes of 36 patients. 29 males(53.7%) & 25 females (46.3%). The control group contained 54 eyes of 45 patients 32 males (59.3%) &22 females(40.7%).Mean age in NO NPDR group was 60.2±7.05, mean age of NPDR/CSME- group was 57.75±7.69 mean age of NPDR/CSME+ group was 57.06±7.14,mean age of control group was 54.39±6.03 were included in the analysis.

Table 1. Distribution of Age & duration of Diabetes

Group	Age (years)	Duration of diabetes (years)
Control	54.39±6.03	
NPDR/CSME-	57.75±7.69	13.04±6.91
NPDR/CSME-±	57.06±7.14	13.54±6.97
No NPDR	60.2±7.05	8.80±2.78
Total	57.12±7.27	12.91±6.77

Mean Best-Corrected Visual Acuity (BCVA) in NO NPDR group 0.08±0.11, NPDR/CSME(-) group logMAR 0.21±0.22, in NPDR/CSME(+) group logMAR 0.43±0.41 and in control group logMAR 0.1±0.13

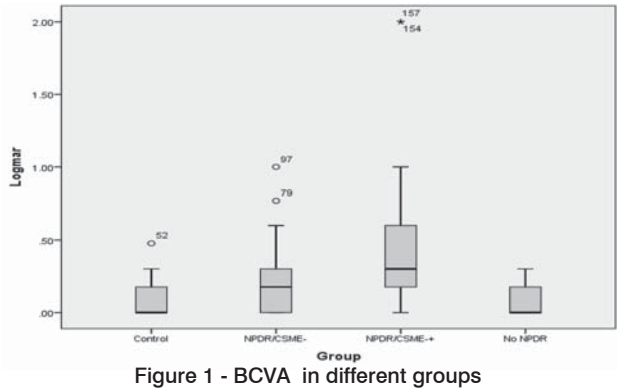


Figure 1 - BCVA in different groups

Mean central macular thickness in microns (CMT) was 226.90±17.67 in NO NPDR group,222.64±30.86 in NPDR/CSME(-) eyes, and 340.81±103.73 NPDR/CSME(+)eyes & in control group 225.30±25.92

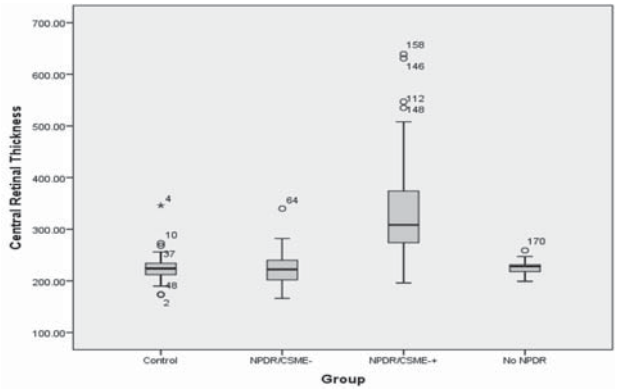


Figure 2 - Central Retinal Thickness Distribution

The mean Subfoveal Choroidal Thickness was significantly reduced in each diabetic group compared with the control group ($P < 0.001$).

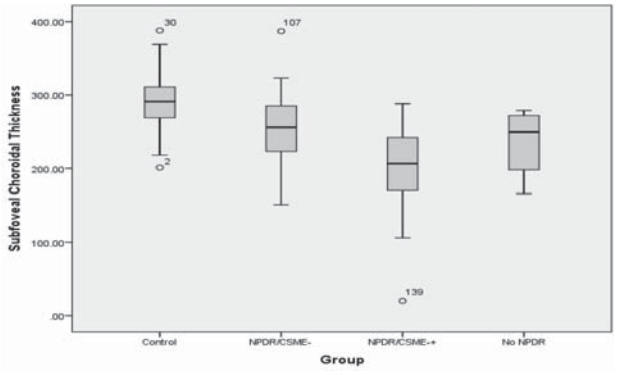


Figure 3 - Subfoveal Choroidal Thickness Distribution

Similarly, the mean choroidal thickness was significantly reduced in NPDR CSME(-) and NO NPDR group at inferior, nasal and temporal ETDRS sector (individual axial choroidal thickness over the horizontal and vertical line scans at 1500-μm interval from the fovea to nasal, temporal, superior, and inferior from the center of the fovea) compared with the control group, while mean choroidal thickness was signifi-

cantly reduced in all the sectors in NPDR/CSME(+) group. In the NO NPDR group, no correlation was found between BCVA and CMT (Pearson's rho = 0.12, P = 0.47); BCVA and choroidal thickness at the fovea (Pearson's rho =-0.13, P =0.26); and between CMT and choroidal thickness in the fovea (Pearson's rho =-0.26, P=0.8).In the NPDR/CSME(-) group, no correlation was found between BCVA and CMT (Pearson's rho= -0.18, P=0.36); BCVA and choroidal thickness at the fovea (Pearson's rho=0.16, P= 0.78); and between CMT and choroidal thickness in the fovea (Pearson's rho=-0.056, P=0.524). In the NPDR/CSME(+)group, no correlation was found between BCVA and CMT (Pearson's rho=0.10 P = 0.407); BCVA and choroidal thickness at the fovea (Pearson's rho=-0.33, P=0.441); and between CMT and choroidal thickness in the fovea (Pearson's rho=-0.33, P=0.30). In the laser group, the pre laser mean central retinal thickness(CMT) in microns was 241.68±46 and post laser 265.95±82 p value(0.29). Pre laser subfoveal choroidal thickness (in microns) was 235.27±62 &post laser 220.5±41p value(0.049)

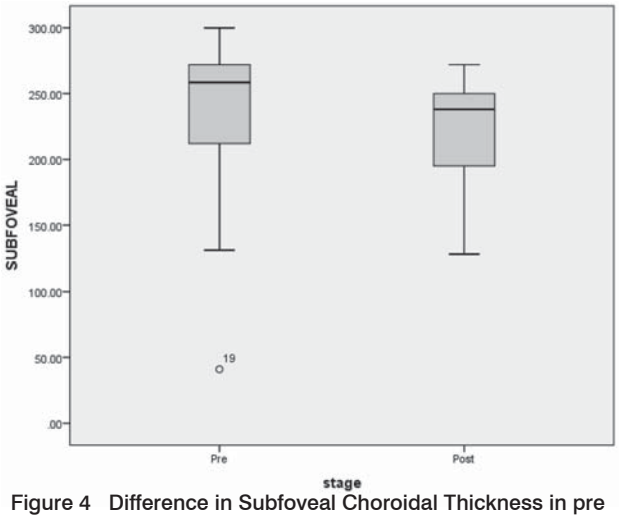


Figure 4 Difference in Subfoveal Choroidal Thickness in pre & post laser groups

Discussion

A structurally and functionally normal choroidal vasculature is essential for function of the retina, abnormal choroidal blood volume and/or compromised flow can result in photoreceptor dysfunction and death. Diabetic retinopathy is due to the breakdown of retinal vasculature[1] integrity and hemodynamic abnormalities[2]. Studies of Doppler flowmetry indicated that the choroidal blood flow may decrease in the early stage of diabetic retinopathy, and decrease further in the presence of macular edema[3]. Similarly, histological studies suggested that Diabetic Retinopathy may cause atrophy of the Choriocapillaris endothelium[4]. The Choroidal Vasculature, especially the Choriocapillaris, provides oxygen and nutrients to the outer retina and is responsible for maintaining the highly metabolically active photoreceptor cells[5]. Since there is no retinal vasculature in the foveal region, impairment of the choriocapillaris may cause severe functional damage to the retinal tissue in the fovea. Therefore, in vivo evaluation of the structural changes in the choroid might be very insightful to determine the pathogenesis of progression of the macular changes in diabetic eyes. Spectral-domain optical coherence tomography (SD-OCT) technology improves resolution, compared with time-domain OCT. SD-OCT scans show bands that seem to correspond to the anatomic layers of the human retina, and allow seeing even small retinal details of photoreceptor layer, such as the inner segment/outer segment (IS/OS) junction. Recently, a new approach to improve depth imaging by OCT, termed enhanced depth imaging (EDI) OCT, has been shown to be able to reliably image the full-thickness of the choroid[6]. EDI OCT uses SD-OCT equipment (CIRRUS HD OCT) positioned closer to the eye than ordinary, such that a stable inverted image is produced. The net effect of this practice is that the sensitivity of the imaging in deeper layers of tissue is increased. In this fashion, EDI OCT may represent a useful approach to investigate, in vivo, the choroidal changes in eyes with diabetic retinopathy. In this investigation, SD Cirrus HD-OCT was used with light source centered on 800-nm wavelength, achieving 5-μm axial resolution in tissue. Previously, the full thickness of the choroid could not be seen in most eyes because of scattering and insufficient light penetration beyond the retinal pigment epithelium, and signal strength roll-off distal to the zero-delay line. Decreased signal strength posterior to the retinal pigment epithelium is compensated by the image enhancement software, which enables visualization of the border where choroidal tissue meets sclera and allows CT measurements to be performed. In this study, using EDI OCT, we investigated the choroidal thickness within the macula of eyes with various stages of diabetic retinopathy and compared the measured values with those of healthy normal subjects. Overall, we found that there was a reduction of choroidal thickness in each diabetic group (NO NPDR, NPDR/CSME-, and NPDR/CSME+) compared with the control group (age- and sex-matched healthy subjects) Previous histologic studies revealed that, in eyes with diabetic retinopathy, there is atrophy[4] and dropout of the choriocapillaris[7,8]. Thus, if choroidal thinning is indicative of a loss of choriocapillaris, our in vivo findings may be in agreement with the histologic studies[4,8,9]. Moreover, our findings are consistent with circulatory studies showing a decreased pulsatile ocular blood flow in diabetic patients[9]. In fact, the dropout of the choriocapillaris could increase vascular resistance, resulting in decreased blood flow in the choriocapillaris[3]. Previous studies demonstrated that a decreased choroidal blood flow may occur before the

clinical manifestations of diabetic retinopathy. Similarly, in the current series, the choroidal thickness value obtained in the NO NPDR group was lower than that in the age-matched control group. The choroidal blood flow value in the foveal region in NPDR/CSME+ eyes has been reported to be lower than that in NPDR/CSME- eyes. Accordingly, in our series, the choroidal thickness value at the fovea decreased further in the presence of macular edema (NPDR/CSME+versus NPDR/CSME-and NO NPDR). These data give insights to the mechanism of diabetic macular edema. The decreased choroidal thickness at the fovea, probably due to the dropout of the choriocapillaris (and determining increased vascular resistance), may cause retinal hypoxia. In fact, it is the role of the choroidal vasculature, especially the choriocapillaris, to provide nutrients to the RPE and outer retinal layers in the foveal region[5]. Due to tissue hypoxia, VEGF expression increases in RPE, pericytes, and microvascular endothelial cells[11], and may induce breakdown of the blood-retinal barrier, which is on the basis of macular edema, in patients with diabetes[12,13,14]. In turn, a decreased choroidal thickness at the fovea may cause tissue hypoxia and consequently increase the level of VEGF, resulting in the development of macular edema as a result of breakdown of the blood-retinal barrier. Diabetic macular edema has been classically attributed to inner retinal capillary changes. However, some eyes with marked macular capillary changes do not develop diabetic macular edema. This suggests that retinal capillary abnormalities are not the only contributor to diabetic macular edema.

Our current findings corroborate the idea that coexisting changes in the RPE, choroid, vitreous, or systemic circulation may be necessary for diabetic macular edema to occur.

Conclusions

In our study we found that there was a reduction of choroidal thickness in each diabetic group (NPDR/CSME-, and NPDR/CSME+) compared with the control group (age- and sex-matched healthy subjects).The choroidal thickness value at the fovea decreased further in the presence of macular edema (NPDR/CSME+ versus NPDR/CSME-). Focal laser causes significant reduction of subfoveal choroidal thickness at 4 weeks follow up.

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Original Article

Structural and Visual Outcomes after Epimacular Membrane Surgery (EMMS) with Internal Limiting Membrane Peeling (ILMP)

Dr Sonia Rani John MS, Dr Meena Chakrabarti MS, Dr Arup Chakrabarti MS

Purpose: To study the long term visual outcome and macular structural changes in 130 consecutive patients who have undergone Epimacular Membrane Surgery (EMMS) with Internal Limiting Membrane Peeling (ILMP)

Method: Retrospective review of the visual outcome and OCT changes at 1,3,6,12 months postoperatively.

Results: Visual acuity improvement at 6 months (>6/9) decreased by 2 lines (<6/18) at 12 months in 80%. Recurrence (5%), macular hole (3%) and peripapillary retinal nerve fibre layer thinning observed. RNFL thinning in superotemporal, inferotemporal and temporal quadrants [(150.6± 19 μm Vs 165.7±23.4 μm ($p<0.001$), 125.3 ± 24.8μm Vs 136.22±7.2μm ($P<0.05$), 70.2+17.4 μm Vs 98.5± 23.7μm ($p<0.001$)] was statistically significant.

Conclusion: Retrospective review of visual outcome and OCT changes at 1,3,6,12 months postoperatively in patients undergoing EMMS with ILMP showed peripapillary RNFL thinning from baseline values which could be responsible for diminution in vision at 12 months after initial visual recovery. Recurrence and macular hole formation were other causes.

Background Statement: This study was undertaken to study the long term visual outcome and macular structural changes in 130 consecutive patients who have undergone EMMS with ILMP in a population of South Indian subjects.

Epiretinal membranes (ERMs) were initially described by Iwanoff in 1865.[1] Epiretinal membranes have been described in 5.3 % to 18.5 % [2-5] of the population and the incidence increases with age, with 2% incidence at the age of 50 and 20 % incidence at the age of 75 by examination of autopsy eyes.6 ERMs are bilateral in up to 20 % of patients[7] and can cause metamorphopsia and reduced visual acuity (VA) by several mechanisms including macular distortion, vascular leakage, shallow tractional retinal detachment and opacity from the ERM itself.[8] Vitrectomy and ERM peel, first performed by Machemer[9] in 1978, is now a well established procedure with visual acuity (VA) improvement by two Snellen lines in up to 90% of patients.[10,11] Visually significant recurrence of ERM is being reported at 3 %.[11]

Histologic evaluations of tissue removed during vitrectomy showing the internal limiting membrane (ILM) to be a common feature enhanced our understanding of the underlying pathology and helped to develop the surgical technique as applied today.[12-14] Despite single reports on possible adverse effects of ILM peeling during macular pucker surgery,[15] the surgical removal of ERMs and the ILM has become a standard procedure in ophthalmology. A previous prospective study evaluating the effect of ILM peeling in macular hole surgery showed no ERM formation after a follow-up of 32 months.[16] This is applicable also in macular pucker surgery to prevent recurrences by eliminating a potential scaffold for cellular proliferation.

Application of dyes such as indocyanine green (ICG) and trypan blue during ERM surgery has become popular to assist the removal of ERM's, the ILM or both. Whereas the use of ICG to assist ILM peeling is controversial, with some investigators describing possible adverse effect on functional outcome and others observing no dye-related-complications, no such problems have been reported along with the application of Trypan Blue or Brilliant Blue G (BBG) in clinical practice. Intraoperative application of dye helps better visualization of the epiretinal tissues and ILM & facilitates their easy removal.

The choice of dye in macular surgery is governed by the ability to stain the posterior cortical vitreous, the ERM and the ILM. 0.5 ml of 0.06% trypan blue (TB) used in this procedure stains both the ERM and the ILM faintly.

Aim of study:

The aim of this study was to evaluate the long term visual outcome and macular structural changes in 130 cousecutive patients who underwent epimacular membrane surgery with internal limiting membrane peeling.

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Patients and Methods:

This was a retrospective consecutive case series analysis which reviewed the visual outcome and OCT changes of 130 eyes of 130 consecutive patients who underwent vitrectomy for epiretinal membrane formation. Out of the 130 cases, 98 were females and 32 males. Only patients with idiopathic macular pucker were included in this study. Patients with ERM in association with other retinal diseases were excluded. Hence patients with ERM associated with diabetic retinopathy, age-related macular degeneration, uveitis, retinal detachment, macular hole and prior ocular surgery were excluded. Informed consent was obtained from all patients.

Preoperative and postoperative routine examination included determination of best corrected visual acuity, applanation tonometry, biomicroscopy with a 90-D lens, binocular indirect ophthalmoscopy and high resolution cross sectional imaging of the retina provided by optical coherence tomography. Digital fluorescein angiography and Humphery C30-2 field charting were done in selected cases.

Surgery was performed by a single surgeon using the following standard technique. A standard three port vitrectomy was performed in all patients using peribulbar anesthesia. The infusion cannula was placed in the infero temporal quadrant. All cataractous eyes underwent phacoemulsification with intraocular lens implantation before pars plana vitrectomy. After core vitrectomy, the posterior vitreous was separated from the retina, if still attached. Posterior hyaloid separation was achieved by active suction with the vitrectomy probe, around the optic nerve head. The epiretinal membrane was then dissected from the retinal surface using a blunt spatula to loosen the membrane, followed by peeling using intraocular 23 G end gripping forceps. 0.5 ml of 0.06 % trypan blue solution was used to stain the membrane. The dye was completely washed out by irrigation after 10 seconds. The internal limiting membrane was removed by a technique of maculorhexis similar to the capsulorhexis in cataract surgery, by initiating a tear in the inferior quadrant using a spatula and extending the tear by using a blunt spatula.

All patients were reviewed on the first postoperative day followed by 1,3,6 & 12 months post operatively.

Results & Analysis:

The age ranged from 48 to 72 years with a mean age of 60 years, 32 were males & 98 females. The preoperative best corrected visual acuity ranged from 6/18 to 5/60. The duration of follow up was 12 months. Post operatively BCVA improved to $\geq$ 6/ 12 in 80% & 6/18 -6/60 in 20%. There was no improvement in VA in 12 % from the baseline visual acuity.

The preoperative central retinal thickness as measured from the OCT scan ranged from 450 to 690 micrometers. The OCT scan also demonstrated total (global) epiretinal membrane adherence in 30 % & localized adherence in 70 %. Vitreomacular traction was observed in 30 % (39 patients) .The retinal nerve fiber layer thickness was normal in all patients preoperatively ; 52 patients (40 %)patients were pseudophakic. Post operatively the central retinal thickness reduced by $\geq$ 50 % of the mean baseline value in 80 % of cases.

Metamorphopsia decreased significantly in all the patients with reporting of no distortion postoperatively at 12 months follow up. Distortion is a marked visual symptom produced by ERM & its resolution is often associated with patient's subjective satisfaction even if the snellen VA fails to improve. No residual foveal ERM was noticed in any of the cases. Residual postoperative extra foveal membrane was noted in 5 % cases which was not considered clinically significant to justify further surgical intervention.

Post operative improvement in distance and near VA failed to reach statistical significance. However 80 % patients experienced improvement of VA and a BCVA of $>$ 6/9 at 6 months, but the BCVA dropped to 6/18 at the end of 12 months follow up.

This is in contrast to previously reported improvement in VA by 2 snellen lines to up to 90%. Failure of VA improvement may be related to the development of cataract (75 %) observed in this study where the end point was 6 months & cataract surgery has been performed in all these patients. Post operative cataract progression may also lead to reduction in contrast sensitivity in these patients.

3 % patients developed macular hole postoperatively
5 % of the patients developed recurrence of epiretinal membrane after 6 months.

The pre operative and 6 months post operative RNFL thickness were compared. The mean RNFL thickness in the various clock hours with the fovea as centre is give in Table I

TABLE I : Mean RNFL Thickness

Clock hours of involvement	Pre operative RNFL thickness	Post operative RNFL thickness
1. 120clock -3 0clock (SN)	108.53 ± 21.63 μm	110.34 ± 18.93 μm
2. 30clock-60clock (IN)	106.51 ± 22.76 μm	108.39 ± 20.98 μm
3. 60clock -90clock(IT)	136.22 ± 7.2 μm	125.3 ± 24.8μm
4. 90clock - 120clock (ST)	165.7 ± 23.4 μm	150.6 ± 19 μm

The subjective visual improvement in the form of reduced metamorphopsia was experienced by all in our series of patients despite presence of structural macular changes as evidenced by the statistically significant reduction in RNFL thickness at 12 month follow up. The following table II and Fig 3 demonstrates the slow and sequential decline in the RNFL thickness in the serial OCTs performed at 7th day , 3,6 and 12 months after the surgical procedure.

TABLE II Comparison of RNFL thickness at various post operative periods

MEAN RNFL THICKNESS				
QUADRANT TESTED	7 days POP	3 months POP	6 months POP	12 months POP
1. 120clock -3 0clock (SN)	116.50 ± 20.03	110.38 ± 14.53	110.2 ± 18.91	110.0 ± 18.93
2. 30clock-60clock (IN)	116.13 ± 23.39	109.27±21.83	106.29 ± 20.45	108.39 ± 20.98
3. 60clock -90clock(IT)	142.59 ± 25.87	139.65 ± 22.91	129.50 ± 23.11	125.30 ± 24.80
4. 90clock - 120clock (ST)	169.63 ± 22.90	162.01 ± 19.43	159.45 ± 22.58	150.60 ± 19.67

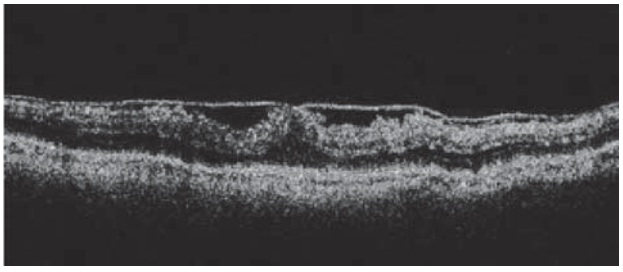


Fig 1 Pre operative OCT

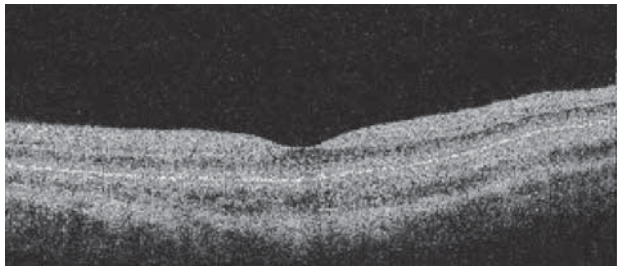


Fig 2 Post operative OCT at 6 months

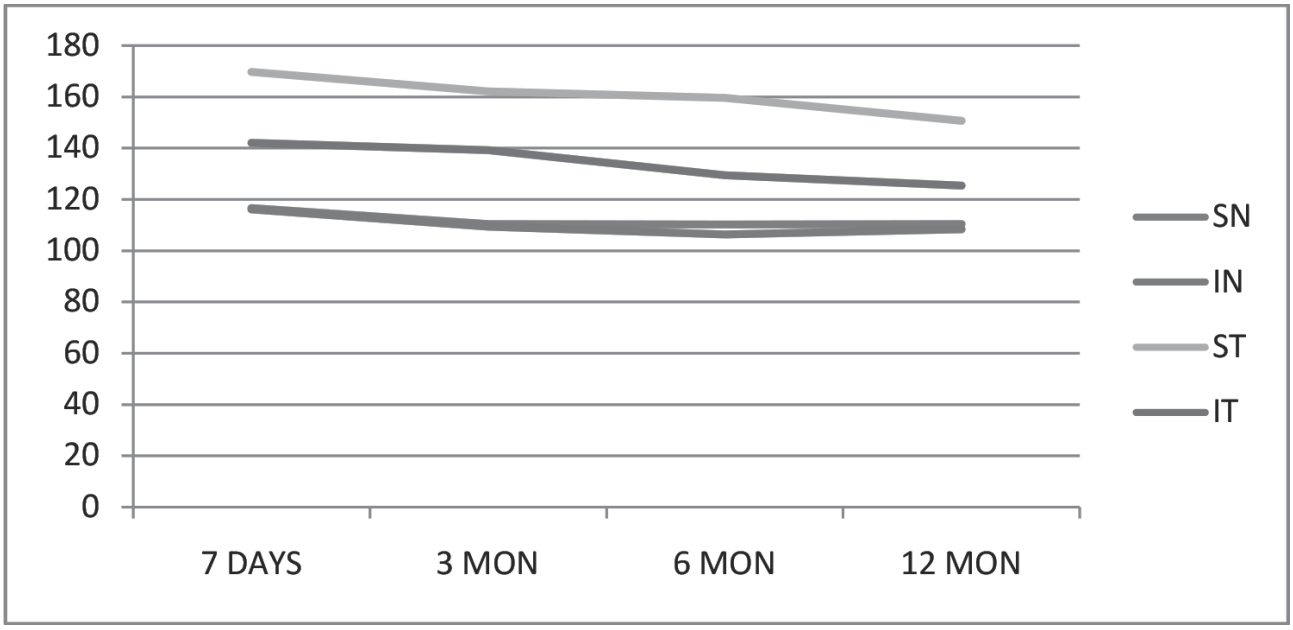


Fig 3: Graph showing progressive decline in RNFL thickness from baseline values.

Visual field defect due to peripapillary RNFL thinning following vitrectomy with internal limiting membrane peeling has been reported. Haritoglou and associates [16] reported that 8 of 105 patients had anatomic macular changes (for example, macular edema and retinal pigment epithelium changes). Furthermore, 59 eyes had asymptomatic paracentral scotomata postoperatively, which the authors felt was due to trauma to the nerve fibers during ILM peeling. It has been shown that the removal of the ILM had no adverse effect on visual acuity in macular hole surgery, although the selective delay of recovery of the focal macular electroretinogram b-wave suggests and alteration of retinal physiology in the macular region[19].

In a histopathologic study of idiopathic epiretinal membranes removed during vitrectomy, ILM was present in most of the specimens[15], which means ILM is often removed together with the epiretinal membrane even if intentional ILM peeling is not performed. Tadayoni and associates[17] reported numerous arcuate striae within the posterior pole in the direction of the optic nerve fibers that were slightly darker than the surrounding retina, called dissociated optic nerve fiber layer appearance, after removal of an epiretinal membrane. They started that this feature had no functional effect and did not preclude good visual recovery. Similar finding were reported by Sivalingam and associates[15]. They stated that this feature had no functional effect and did not preclude good visual recovery. Sivalingam and associates[15] reported, however, that the presence of long segments of ILM within the histopathologic specimen after removal of a macular ERM appeared to indicate a less favorable visual outcome. Most recently, Kim and associates[18] described visual field defect after uneventful epiretinal membrane surgery. The authors concluded that adhesion between the epiretinal membrane and retinal tissue in the area of the ILM defect might cause damage to the nerve fiber layer, producing the defect. It therefore cannot be excluded that the RNFL thinning in our series may be the result of a direct trauma to the nerve fibers during ILM peeling. It is unlikely that localized damage to the nerve fiber layer in the macula leads to these significant peripheral field defects, even if extensive ILM was removed. Furthermore, no visual field defect has been found in large series of eyes with ILM removal for macular hole.

Despite documented evidence of structural macular damage in the form of progressive decrease in RNFL thickness, all our patients reported symptomatic relief from metamorphosia. The 2 line decrease in Snellen VA at 12 months was in fact not noticed by the majority of patients.

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"Glautrak": A Surgical Procedure that can Save Vision in End Stage Non Responsive Glaucoma

Dr. Anil. B. Das MS.DO.

Introduction

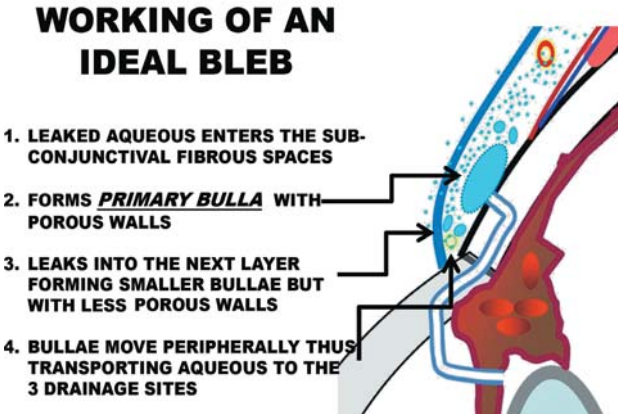
End stage non responsive glaucoma is a condition where despite full possible therapy (either medical or surgical) there is progression in visual fields and persistent elevation of Intra Ocular Preassure (IOP) which if allowed to continue can lead to blindness.

Glautrak is a surgical procedure which can reduce IOP in such cases specifically. It is effective even in cases associated with complications like shallow AC, complete occlusion of angle, neovascularization, aniridia, ICE Syndrome, persistent uveitis, iridodialysis, angle recession etc.

Principles on which this procedure is based

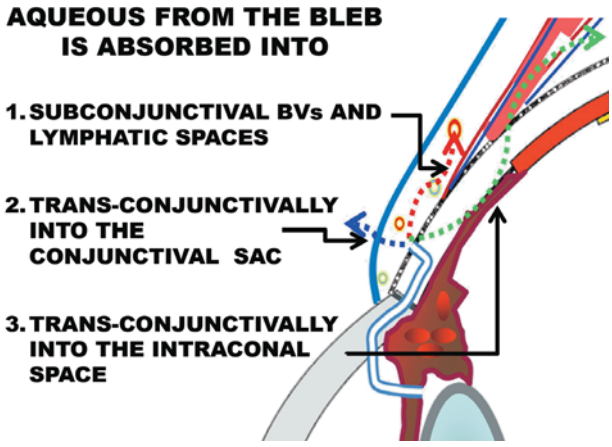
How does aqueous drain in an ideal trabeculectomy bleb?

After leaking out from the scleral flap the aqueous reaches the spongy fibrous spaces in the subconjunctiva where it forms a large bulla. (Very much similar to the bulla formed when we give a sub-conjunctival injection). From the periphery of this large bulla (primary bulla) the aqueous



forms micro bullae which unlike the primary bulla can move[1]. These micro bullae then discharge their collection of aqueous into 3 possible spaces

1. Conjunctival sac
2. Sub conjunctival blood vessels and lymphatics
3. Intraconal space



Causes of failure

Block occurs when the aqueous draining out of the scleral flap cannot form the primary bulla. Due to fibrosis of subconjunctival tissues from dense adhesions, old age, surgical scarring etc. dense adhesions form between the conjunctival epithelium and the sclera known as the 'ring of steel.'

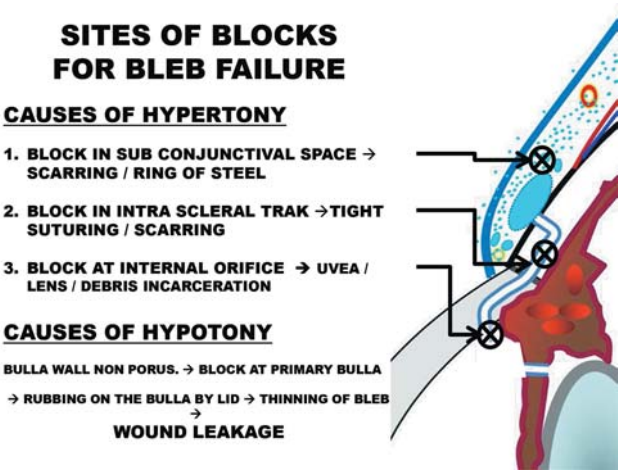
Another sequel is that primary bulla is formed but smaller micro bullae are not (due to deficiency of subconjunctival connective tissue). Here the wall of primary bulla thins out in the anterior aspect due to constant rubbing of lids leading to its thinning / erosion and consequent engorgement.

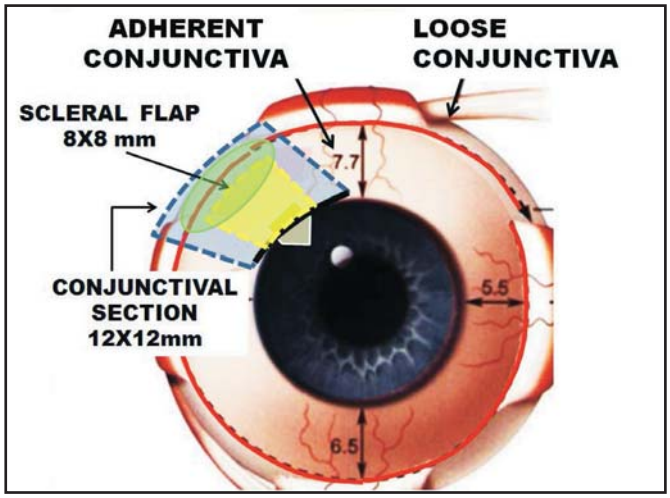
This thin wall develops micro-ruptures leaking aqueous into the conjunctival sac leading to hypotony. Sometimes the leak can be large in which case the Anterior Chamber (AC) can collapse. This large bleb by constant rubbing can posteriorly erode the scleral flap causing its thinning producing a staphyloma.

Other sites of obstruction are

1. At the internal orifice due to incarceration of iris / lens tissue, or by inflammatory / hemorrhagic debris[3].
2. Under the scleral flap due to tight suturing / fibrosis.

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How does Glautrak overcomes all these?
The basic difference in this procedure from classical trabeculectomy is to displace the incision from limbus to somewhere near the insertion of the superior rectus. Dr. Khaw makes a larger scleral flap not cut all the way to the limbus, thus directing aqueous flow posteriorly. The principles involved in this procedures is the basis of the 'Glautrak'. The bleb is shifted away from the limbus to somewhere near the insertion of the rectii muscles.

This provides certain features which prevent factors that lead to trabeculectomy failure.

Subconjunctival tissue is much more profuse near the equator than near the limbus – so less risk of external orifice blocking / non formation of micro bulla.

There is no lid margin to rub on the bleb thinning it.

Scleral thinning is minimal because of lack of lid pressure on bleb in this situation.

The important outflow from this point will be towards the intraconal space (the area where the Ahmed Glaucoma Valve drains), hence the bleb spreads posteriorly from here rather than anteriorly (as seen in large blebs of classical trabeculectomy).

The long scleral tunnel will not get blocked because of the presence of the Glautrak implant in it.

The internal orifice is prevented from obstruction by a large iridectomy which along with the long scleral tunnel prevents a shallow AC.

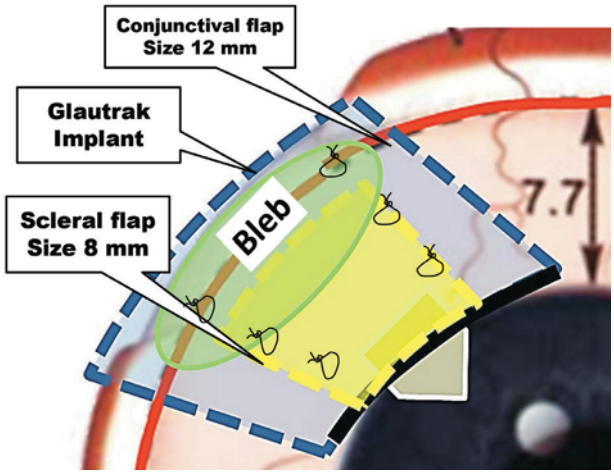
The surgical procedure

A large trapezoidal limbal based conjunctival flap, approximately 12 mm in size is dissected starting from the intraconal space near the equator between the superior and lateral rectus taking care not to injure these muscles. Care is taken to see that there is minimal disturbance to the underlying subconjunctival connective tissue when it is separated from the sclera.

Now an 8mm rectangular scleral flap is taken which is lifted up and the Glautrak implant (7-0 nylon suture non absorbable) is fixed on the scleral bed.

The trabeculectomy and a generous iridectomy are performed.

The scleral and conjunctival flaps are sutured back.



Conclusion

The procedure though simple is a bit time consuming and requires good exposure and extensive dissections.
Risk of perforation of scleral flap / tunnel floor is present during dissection and if it occurs may require surgery at a different site.

Regular follow up is required to see that there are no complications for at least 3 months.

If anything untoward happens never delay in intervening, as the risk of delay is much higher if proper corrective measures are not taken at the apt time.

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SICS Tips for General Ophthalmologists

Dr. Philip Kuruvilla MBBS, D.Oph, MS, F.O.P.A.I., F.O.R.C.E.

(This article does not cover all aspects of SICS; rather it concentrates on some points of pragmatic significance)

(SIA: surgically induced astigmatism; LRI: Limbal relaxing incision; WRA: with the rule astigmatism; ARA: against the rule astigmatism; Postop: postoperative; ACM: Anterior Chamber Maintainer; CCC: continuous curvilinear capsulorhexis; PCR: Posterior capsular rupture)

There is SICS and 'SICS'. There is SICS done haphazardly for "camp cases" (aim: no vision to some vision) and 'SICS' done with meticulous care (aim: send him home same day, clear cornea, no iritis and nil astigmatism). I would urge every surgeon to be in the second category even if it is "free surgery".

BLOCK OR TOPICAL?

Doing surgery under block is elegant. Because it is hard to know how they are going to behave after we start surgery. Risks of such unpredictability of patient's behaviour in the theatre are minimised. But there are advantages of doing under topical anesthesia (TA): as the optic nerve is not blocked, he is able to see immediately after surgery. Overnight padding is not mandatory. Chances of oculocardiac reflex and resultant bradycardia are minimal. No risk of perforation of globe. Cuts down time and cost[1].

Draping the eye with a sticky drape and speculum without block can be difficult. I follow the following method: first, instil paracaine drops (stinging is minimal), then literally irrigate the conjunctiva (not cornea) with 2% xylocaine before sticking the drape. The drape must completely cover the lid margins and the uncut lashes after we apply speculum.

If in case he squeezes a lot while we instil 2% xylocaine drops, it is likely that he is going to squeeze during the rest of the time. I find it useful to give inj xylocaine 1 % on both the lids into the orbicularis muscle with a 24 G needle: slowly given, the patient may not even know ! The partial lagophthalmos wears off within couple of hours.

Through out the surgery, keep putting 2% xylocaine drops from a syringe on the conjunctiva (not cornea), esp while cutting the sclera. Rarely, intracameral lignocaine (oculan) will be needed. Most of the time you will come out unscathed. However, I would not suggest TA for an uncooperative, overly anxious patient (when they move their eye and the head, they are not even aware of what they do !) with a deep set eye with non dilating pupil, synechiae and pseudoexfoliation! The risks of ocular discomfort is pretty high in such complex cases and TA surgery is generally counterproductive to a relaxed surgical environment. Our soothing verbal anaesthesia may not help.

CONJUNCTIVAL FLAP?

For a superior incision, my present technique is not to have any flap . The cut is made over the conjunctiva down to half thickness of sclera. No cautery. Wound healing is fast and good.[2]

A temporal incision made in the same way may result in the limbal surface to be slightly uneven. Rarely, this irregularity causes a dry patch on the peripheral cornea and dellen formation. If such a patient is careless in putting lubricating drops or in coming for follow up, we are in trouble. So I do a limbus based flap (cut conjunctiva 4 mm away from the limbus), raise the flap and make the incision under the conjunctiva without cautery. At the end of surgery, stroke the flap over the wound. The limbal area is smooth then. Another advantage is that conjunctiva sticks nicely (because of the little bit of blood there) and protects the wound from postop bacterial influx.

CORRECTING ASTIGMATISM

One of the greatest advantages of SICS is that we can correct pre-existing astigmatism pretty substantially by altering the site, size and shape of the incision. (in phaco surgery scope of such considerations is limited; LRI is an option. In other words, we make use of SIA to correct the astigmatic cornea. If the amount of astigmatism is too much to be corrected by SICS strategies, put in a toric lens as well.

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1. Preop Keratometry (K). Obviously, accurate assessment of pre-existing corneal astigmatism is absolutely important. (Lenticular astigmatism can be ignored as it will disappear with extraction of the cataract). Based on this we are going to try our correcting endeavours. I suggest K readings manually and by machine . The readings have to be repeated by another technician. If they don't tally, do it a third time.

2. Site of incision: A large superior incision can cause considerable flattening of the cornea in the vertical meridian: a spherical cornea may be made 2 D astigmatic against the rule, and a 2D WRA may be totally corrected . This also means that a similar incision will add to the existing ARA by 2D (eg, 1.5 D of pre existing ARA will now become 3.5 D against the rule).

However, a temporal incision causes very little of flattening of the horizontal meridian. It is very difficult to cause more than 0.5 D of SIA. i.e., ARA can be corrected only by 0.5 D by incision alone. For correcting more of pre-existing astigmatism we need to rely on toric IOL.

It follows that for a spherical cornea, to maintain its non astigmatic state after surgery, a temporal incision is safer than a superior one; and for an astigmatic cornea, we need to make the incision at the steepest meridian.

3. Length, shape of the incision and proximity to limbus. Longer the horizontal length, more is the astigmatism produced. More the smile, more is the astigmatism and more the frown, less. Closer to the limbus, more is the flattening effect.

What an SICS surgeon should do is to study how the SIA varies when he changes the type of incision and use that knowledge to correct pre-existing astigmatism.

TUNNEL MAKING[3]

How do we keep the crescent blade in a single plane and prevent a premature entry into AC ? Once half thickness of the sclera is cut, and the tunnel blade is in that plane, keep it flat on the scleral surface and proceed towards the cornea with side to side movements. It will remain in the same plane.

CAN OPENING OR RHEXIS?

In every case we must aim for a rhexis. For SICS, rhexis has to be large as the nucleus has to be rotated through it to the AC. It is not worth struggling through a small CCC (Zonular dehiscence!). If the pupil is non dilating, do a small rhexis and then do relaxing incisions.

Of course, most of the cases do well with a can opener capsulotomy. But in some cases, the sudden rise of IOP caused by fluid from ACM can result in an outward extension of a capsular cut and a PCR. Moreover, on insertion of IOL one or both haptics can go outside the bag.

Obviously, we must not insert a toric or a multifocal lens if we cannot get a nice CCC as accurate postop positioning of the IOL is important.

SIMCOE CANNULA

Simcoe is an excellent instrument for cortical irrigation and aspiration[7]. But one of the concerns is the difficulty in cleaning the lumen (with 90^0 angle of the aspirating port) after surgery before autoclaving and using it again. A dirty cannula (even if autoclaved) can cause TASS or even endophthalmitis as tissue sticking to it can protect bacteria from the autoclaving steam.

So for many years now, I use a single lumen cannula made from a 22 G or 24 G disposable needle: the tip is twisted and broken and rubbed against a hard surface to smoothen and then autoclaved. Not used again. Works well along with ACM.

2% METHYL CELLULOSE

A excellent material indeed[4,5,6]. However, it has to be irrigated out of the AC and from behind the IOL. Many surgeons have observed iritis and rise of IOP by left over methyl cellulose. Some brands available in India seem to cause this problem more than others.

Conclusion: If done well, manual SICS gives excellent results. Although many suggestions are given here, what works best in your hands is what you should practice. However, carelessness and hurry will be punished.

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A Case of Posterior Uveitis

Dr. Reesha K.R. DNB

A 43 year old healthy male was referred with history of defective vision of one week duration in left eye which was associated with minimal pain and redness. He had no history of any systemic illness before. He had chicken pox when he was 10 year old. There was no history of joint pain, skin or oral ulcers or weight loss. On examination he was found to be moderately built and nourished with vitals within normal limits. Visual acuity in right eye was 6/6 with glasses and left eye had 3/60 which improved to 6/60 with -1.50 Dsp/-0.75Dc 75^0. Anterior segment examination of right eye was within normal limits. Left eye showed circum corneal congestion, corneal edema, pigments on endothelium and grade 2 cells in anterior chamber (AC). There was grade 3 RAPD. Anterior vitreous showed grade 2 cells. Fundus examination of right eye was within normal limits. Left eye fundus showed grade 1 vitritis, disc edema, vasculitis involving both arteries and veins. There was a retinitis patch nasal to the disc and multiple retinitis and choroiditis patches in the periphery with serous detachment. Intra ocular pressure recorded were 16 mm of Hg in right eye and 21 mm of Hg in left eye. Provisional diagnosis of posterior uveites was made.

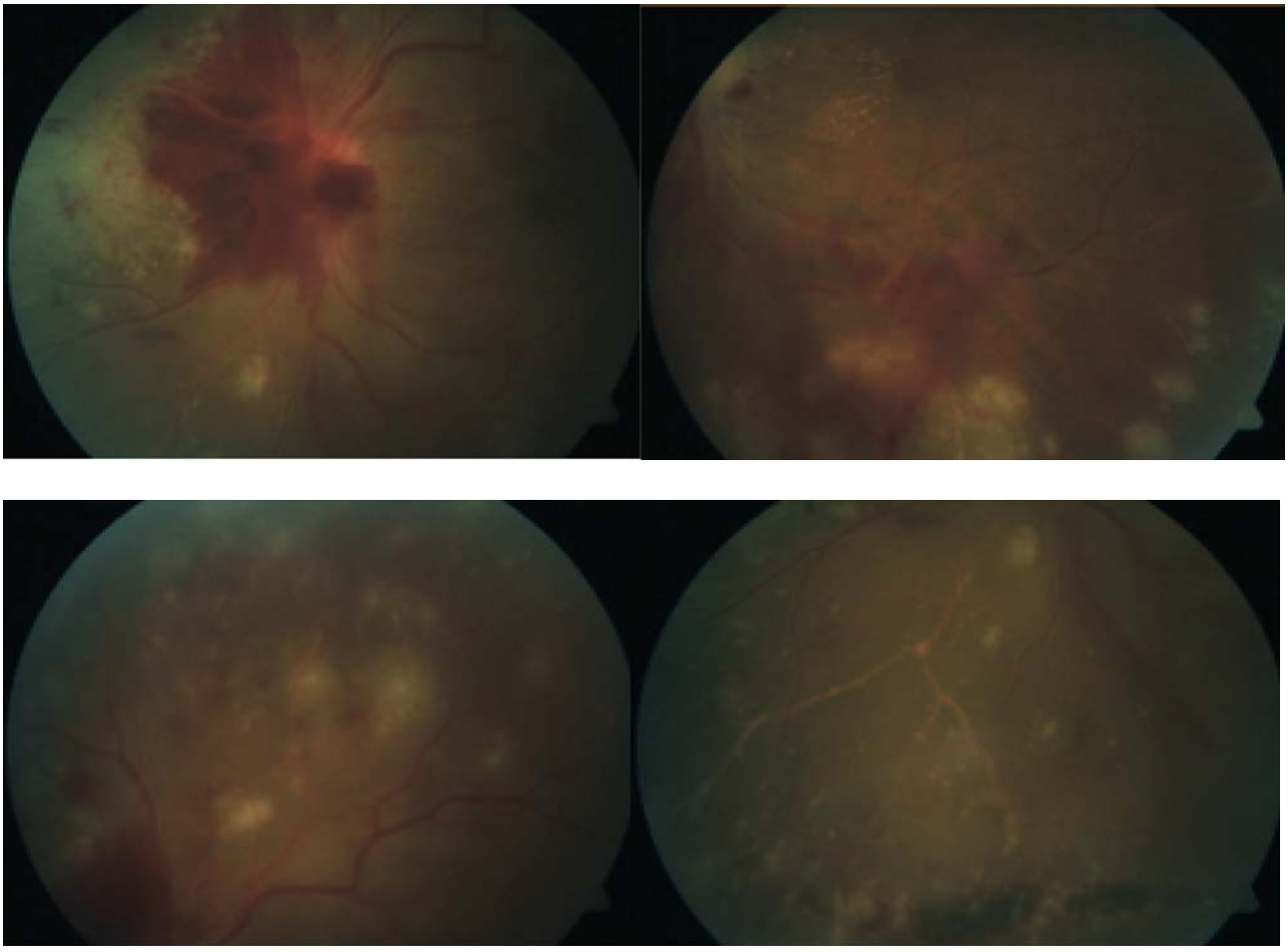


Fig 1: Fundus Photo Showing multifocal retinitis and occlusive vasculitis patches.

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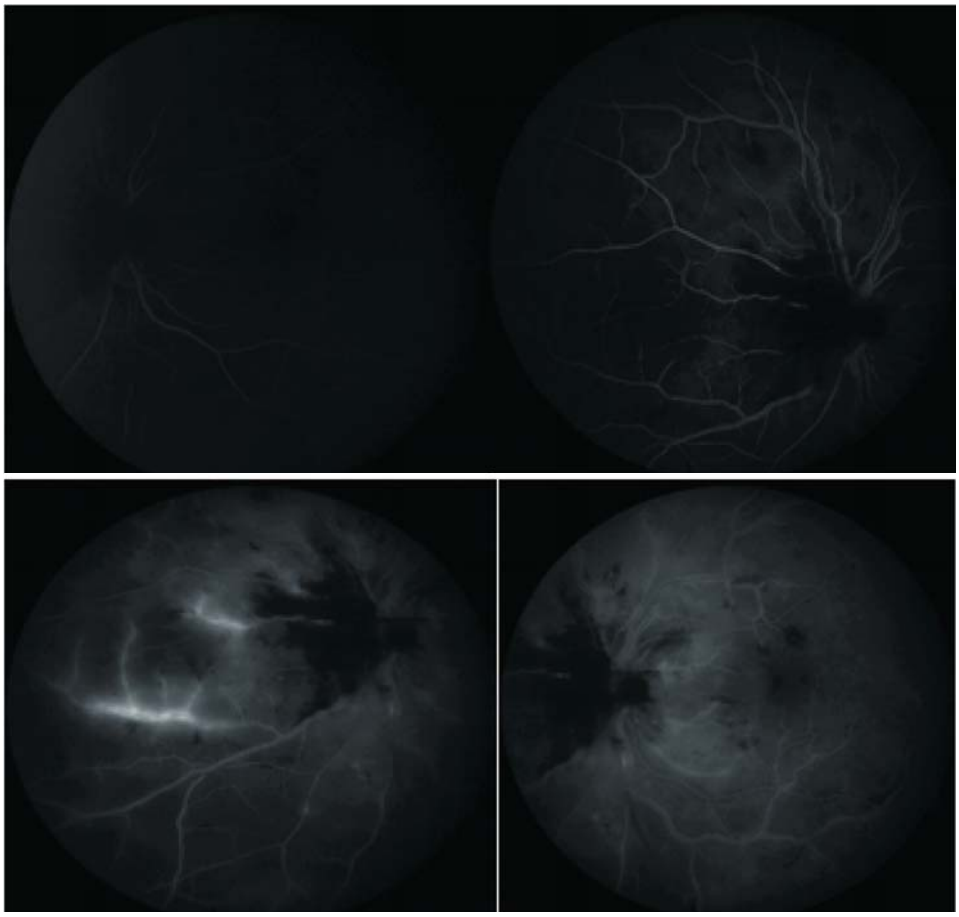


Fig 2: FFA showing leakage of vessels suggestive of vasculitis, blocked fluorescence due to retinal hemorrhages and hypofluorescence due to retinitis.



Fig 3: Fundus picture showing progression of retinitis.

His blood routine was normal. ESR -15 mm/1st hour, Toxoplasma IgG and IgM was negative. Mantoux was negative, VDRL was nonreactive. (Provisional diagnosis of posterior uveitis was made). AC tap was done and sent for polymerase chain reaction (PCR) for mycobacterium tuberculosis, toxoplasma, herpes simplex virus (HSV), varicella zoster virus (VZV) and cytomegalo virus (CMV). He was started on systemic steroids. When he came for review on 5th day the vision was HM. Retinitis patches were found to be increased in size .

AC tap PCR results showed VZV positive and negative for HSV, CMV, Toxoplasma and Mycobacterium. ELISA for Anti retroviral antibody was negative.

Diagnosis of Acute Retinal Necrosis was made. He was admitted and started on intravenous Acyclovir 500 mg TID for 1 week along with steroids. Retinitis patches and vitritis were resolving well . He was discharged with tab. Valcyclovir 1 gm TID along with tab. Wysolone in tapering doses.

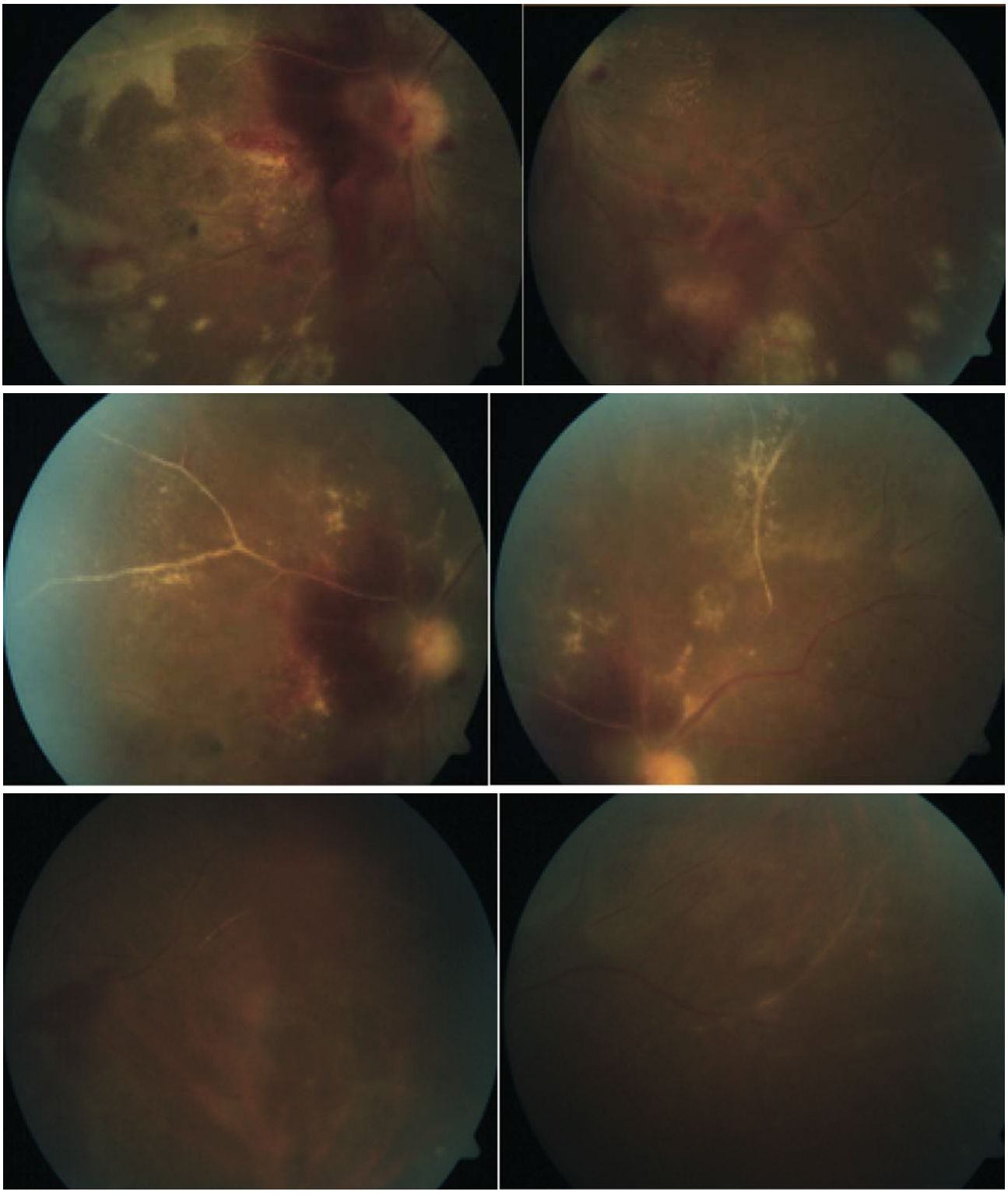


Fig 4: Fundus picture showing resolving retinitis and vasculitis following treatment.

He was continuing the same treatment. At two weeks follow up retinitis patches were resolved. Vision improved to 2/60. He was advised to continue the same treatment and review after one week. He came the next week with sudden deterioration of vision. His vision was no PL this time and fundus picture showed Central Retinal Artery Occlusion .

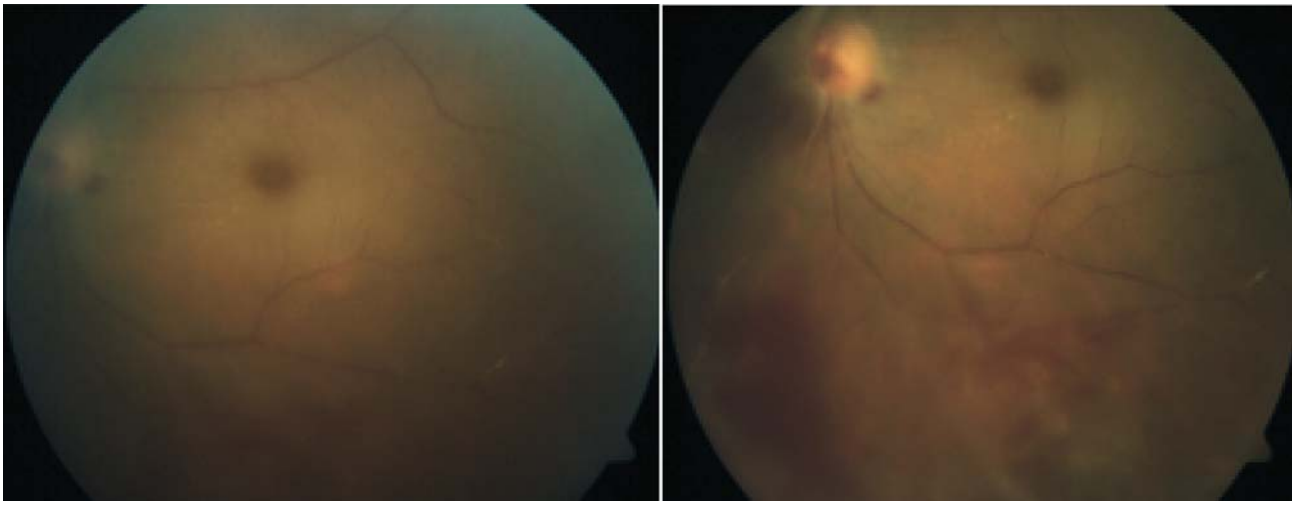


Fig 5: fundus picture showing central retinal artery occlusion.

The questions for discussion are:

How would you have managed this case?
How will you manage this case further?

Dr. Jyothirmay Biswas
Sankara Nethralaya
Chennai

The treatment given to this patient was appropriate. I would have also treated it in the same way[1,2]. Oral valacyclovir 1g 3 times a day has also found to be effective in some recent studies. Few studies also report high dose Inj. Acyclovir (500 mg/sq. m or 10 mg/ kg body weight 3 times a day X 7-10 days) to be effective in cases of ARN due to VZV as compared to HSV.[3,4] The patient came with central retinal artery occlusion on the next visit. Unfortunately there is no treatment for established CRAO following ARN. laser would not benefit Their role is not well proven. I don't recommend.

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S R Rathinam
Aravind Eye hospital
Madhurai

How you would have managed this case?

The above case is well managed. Superficial multifocal retinitis, vasculitis with pain is often ARN. Other differentials are, syphilis and acute toxoplasmosis very rarely tuberculosis in immunocompetant patient. We can rule out syphilis on same day with TPHA. Till I wait for Mantoux (Mx) and spiral CT chest, I usually add oral antiviral, Tab Valcyclovir 1 gm tds with oral steroids on first visit itself. By the time in 2 days when patient comes with Mx and CT chest, we get a more definitive picture and can switch over to intravenous acyclovir depending on the result.

How will you manage this case further?
It is very important to do FFA to see non vascular areas and to follow up for neovascularization. If needed after 3 months we can repeat FFA and perform laser photocoagulation. At least we can avoid neovascular glaucoma and painful blind eye.

Dr. Prakash V.S.
Comtrust Eye Hospital
Calicut

First of all I would like to congratulate you for reaching at a diagnosis and managing the case very well even though the outcome was very unfortunate and entirely unexpected
I would like to discuss the case under 2 headings The diagnosis part and the management The diagnosis of the case as VZV retinitis, even though we have PCR evidence is very much debatable because of many atypical features[3]

1. Age of the patient is not typical for VZV retinitis since it is more common in te 6th to 7th decade
2. Lack of significant vitritis (clear fundus pictures) in an immuno-competent individual for VZV retinitis is very unusual
3. Multifocal superficial non confluent lesions more at posterior pole and less in periphery
4. Presence of large haemorrhages and serous retinal detachments
5. Central retinal artery occlusion is, as far I know, not reported in VZV retinitis but reported in CMV as well as toxoplasmosis

Clinically my differential diagnosis would have been CMV[2] first, fulminant toxoplasmosis second , but then, I would have expected the person to be immunocompromised in either case.

Since your PCR has been negative for these two and he was immuno-competent, I would have thought of Acute multifocal hemorrhagic retinal vasculitis as diagnosis, even though bilaterality is more common. Viral etiologies have been suspected in this disease entity, but not definitely proven. As in this case, response to acyclovir is very poor for this disease. It has been thought of as Best disease without systemic manifestations and can occur unilaterally[1].

Also I would have done a work up for non infectious vasculitis, particularly SLE and PAN. Given the PCR for VZV as the only positive lab test, my management would have been the same. I would not have started systemic steroids early before the investigations if I was suspecting an infectious etiology. As for further management it may be better to do a PRP in this case to prevent NVG

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To summarise

Uveitis may be caused by infectious or non-infectious disorders. Infectious causes should always be considered in all patients with uveitis and it should be ruled out first. Here the initial picture was atypical so that a diagnosis of Behcet's was made, even though we planned to rule out viral retinitis by anterior chamber tap for a PCR. Presentation of VZV retinitis in this young immunocompetent patient was atypical because of the lack of significant vitritis, presence of posterior pole involvement, serous detachment and central retinal artery occlusion. CMV retinitis and multifocal toxoplasmosis should be considered in an immunosuppressed patient with this type of fundus picture. Even though diagnosis of ARN is mainly clinical, atypical presentations are possible in immunocompetent patients. PCR is a very helpful tool in the diagnosis of these patients. We could exclude mycobacterium and toxoplasma infection by a negative PCR and could reach a definitive diagnosis of VZV retinitis. Syphilis should be ruled out in all uveitis patients because it can have protean manifestations. Behcet's should always be a diagnosis of exclusion.

Management includes antiviral therapy and steroids. Treatment includes a 10–14 day course of intravenously administered aciclovir 500 mg/m2 every 8 hours. Oral aciclovir 800 mg five times a day is then continued for an additional 6 weeks. The goal of therapy is to hasten the resolution of disease in the infected eye and to prevent contralateral spread. Systemic corticosteroids such as prednisolone 0.5–1.0 mg/kg can be added after the patient has received 24–48 hours of intravenous aciclovir. Steroids can be slowly tapered based on the amount of vitritis. Valaciclovir offers more convenient dosage regimen. Valaciclovir is rapidly converted to aciclovir and the usual dose is 1 g orally three times daily. In this patient optic neuropathy and vascular occlusion caused the complete loss of vision. Pan retinal photocoagulation may prevent retinal neovascularization and further complications like neovascular glaucoma.

Brief Report

Self Trauma causing Acute Glaucoma

Dr. Thomas Arun Varghese MS, FRCS, MRC Ophth, FAICO, Dr. Sheena Liz Mani DO, DNB, FRCS, FMRF,
Dr. Sruthy K. John DO, DNB.

Abstract:
Trauma is a known cause of glaucoma, however , self trauma is an easily overlooked etiology, often because it is associated with other systemic illnesses viz parkinson's disease and epilepsy and rarely presents in the ophthalmic OPD. We present a case of self trauma causing acute glaucoma in a patient with chorea.

Case report

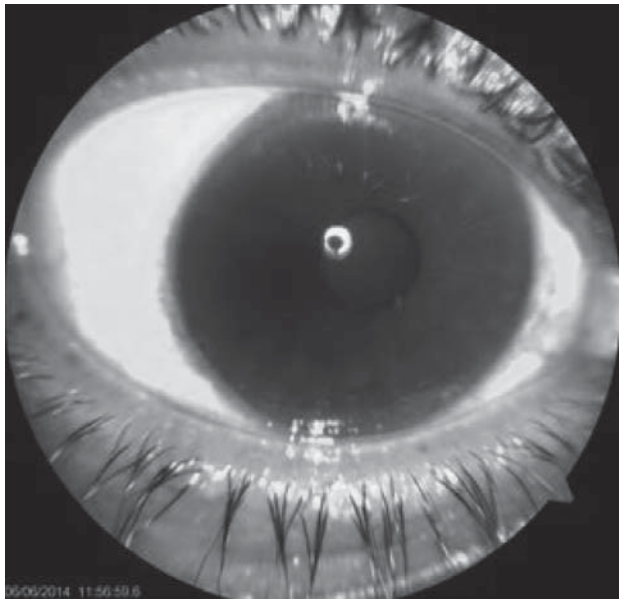
A 50 year old engineer presented with intermittent episodes of pain and redness of the right eye associated with blurring over a period of a few months. He is a known patient of chorea for 6 years and a diabetic for 10 years and on treatment for the same.

Best corrected visual acuities were OD 6/24 N36 and OS 6/6 N6 .Slit lamp examination showed corneal epithelial edema, deep anterior chamber and pigment in the anterior chamber with a posterior subcapsular cataract. Due to the hazy cornea, finer details could not be appreciated. Intraocular pressure (IOP) by applanation tonometry was 50 mmHg. The left eye examination was normal. He was treated with IOP lowering agents, topical timolet, brimonidine and saline 5% along with oral acetazolamide. He was also given topical steroids since the clinical diagnosis at presentation was of inflammatory glaucoma.

The following day the cornea had cleared considerably and the IOP had reduced to 20 mmHg. Slit lamp examination revealed vitreous in the anterior chamber with pigments, variable anterior chamber depth, and phacodonesis- all suggestive of a previous trauma to the eye. Gonioscopy showed closed angles in the superior and nasal quadrants the other quadrants being open upto the trabecular meshwork. Left eye gonioscopy showed open angles.

In the light of the above findings a detailed history was elicited. It was found that the patient's chorea had aggravated a few months back , the movements were very severe including wide flailing of arms, for which he had to be hospitalized and put on a very high dose of intravenous clonazepam. The patient and wife said that it was possible that he may have inadvertently traumatized his eye during the exacerbation.

After lowering the IOP medically, he underwent Nd:YAG peripheral iridotomy. Two iridotomies were done at 4 and 7 o'clock respectively. Additionally, he was put on topical timolol, brimonidine and dorzolamide. He is now pain free and his IOP is well controlled. Fundus examination details were not clear in the right eye due to the cataract, and significant glaucomatous cupping could not be appreciated. The left eye had 40% cupping with mild NPDR and early cellophane maculopathy. He is awaiting lensectomy with IOL after his medical condition stabilises.



Discussion

Chorea is a movement disorder which consists of involuntary,irregular movements that may take either a worm like appearance called athetosis or a more proximal flinging movement called ballismus. It is associated with a large number of hereditary or systemic diseases. The common

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genetic causes associated with chorea are Huntington's disease, neuroacanthocytosis and rarely Wilson's disease.

Chorea can also occur secondary to other medical conditions.

Vascular causes	Stroke, post pump chorea, polycythemia vera
Autoimmune	Sydenham's chorea,SLE
Paraneoplastic	
Metabolic	Non ketotic hyperglycaemia, thyroid disease, renal failure,hypocalcaemia
Drug induced	Dopamine receptor antagonists

Glaucoma following trauma can occur due to various mechanisms – hyphaema, angle recession or subluxation or dislocation of the lens. Pupillary block with angle closure may result from forward advancement of the lens. Pupillary block may also be produced as a result of vitreous blocking the pupillary aperture if the lens has dislocated posteriorly. Treatment of this form of glaucoma is directed at relieving the pupillary block with laser iriditomy or surgical iridectomy. Removal of the lens may be required for reasons of visual rehabilitation or if the lens continues to compromise the angle or cornea because of persistent extreme anterior displacement.

Our patient had a combination of the above with intermittent episodes of pupillary block causing spikes in IOP. However, since it was not recognized and treated appropriately early on, he has secondary angle closure in two quadrants.

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Brief Report

Posterior Segment Effects in Distant Trauma

Dr. Rose Mary Tomy MS,DO., Dr. Jyothi P.T DO.MS., Dr. Padma B Prabhu MS, DNB

Introduction

Vision threatening posterior segment effects of closed globe injury are commotio retinae , vitreous haemorrhage, vitreous base avulsion, retinal breaks and dialysis, retinal detachment, hypotonic maculopathy, optic nerve injury, choroidal rupture and retinitis sclopeteria. Apart from direct coup and counter coup injuries, posterior segment changes are also seen following distant trauma.

We present two cases illustrating the posterior segment effects of distant trauma.

Case 1

A 38 year old male with history of road traffic accident and contusion chest 1 week ago, presented for painless defective vision of the left eye noticed 3 days after trauma. On examination, left eye showed mild periorbital edema, ecchymosis and sub conjunctival haemorrhage. Cornea was clear, pupil was brisk and intra ocular pressure was normal. Best Corrected Snellen Visual Acuity (BCSVA) was 6/36. Fundus (Fig1) showed multiple coalescent cotton wool spots concentrated around the optic nerve head and extending along the vascular arcades in the posterior pole. Right eye examination was within normal limits and had a BCSVA of 6/6. The fundus picture and the history of chest trauma pointed to the diagnosis of Purtscher's retinopathy. The patient was followed up. At one month follow up, (Fig 2) the cotton wool spots were spontaneously resolving and the visual acuity had improved to 6/9.

Case 2

A 37 year old male presented with floaters both eyes of 1 week duration. He had had a history of alleged road traffic accident and head injury two and a half months ago. CT imaging had shown extradural and subarachnoid haemorrhages. He was managed conservatively and discharged on oral phenytoin upon resolution of the haemorrhages on imaging. He was asymptomatic since then. However he had noticed transient blackouts over the past one month. This history was suggestive of absence seizures. On ocular examination, anterior segment of both eyes were normal with brisk pupils and a BCSVA of 6\9. Fundus (Fig 3) showed large confluent superficial haemorrhages around the optic nerve head. The fundus picture was diagnostic of Terson's syndrome. MRI imaging (Fig 4) showed a right subdural haematoma with midline shift and mass effect. Emergency evacuation of the haematoma was done the same day by the neurosurgeon. At one month follow up, BCSVA was 6/9 both eyes and fundus (Fig 5) showed well resolving superficial haemorrhages.

Discussion

The three ocular syndromes described under the distant trauma entity are Purtscher's retinopathy, Terson's syndrome and Shaken Baby syndrome.[1]

Purtscher's retinopathy

Purtscher retinopathy is a hemorrhagic and vasoocclusive vasculopathy, seen following head, chest or long bone trauma.[2] The characteristic white patches and haemorrhages surrounding a normal optic disc was first described by Otmar Purtscher in 1910, in patients with visual loss following severe head trauma. He called it angiopathia retinae traumatica.

Since then, Purtscher retinopathy has been additionally described in long bone fractures and compression injuries of the chest. Purtscher's-like retinopathy is seen in non traumatic conditions as pancreatitis, childbirth, renal failure, barotrauma, steroid injections in and around the orbit and nasal passages, retro bulbar anaesthesia and connective tissue disorders.

Purtscher's retinopathy presents with unilateral or bilateral vision loss generally within 2 days of chest or head trauma. Fundus shows ischemia of the posterior pole characterised by cotton wool spots, retinal whitening and pre retinal and retinal haemorrhages concentrated around the optic nerve head, macular edema and a dilated venous system. Cotton wool spots represent small retinal microinfarcts at the level of the nerve fiber layer. Larger infarcts of the retinal

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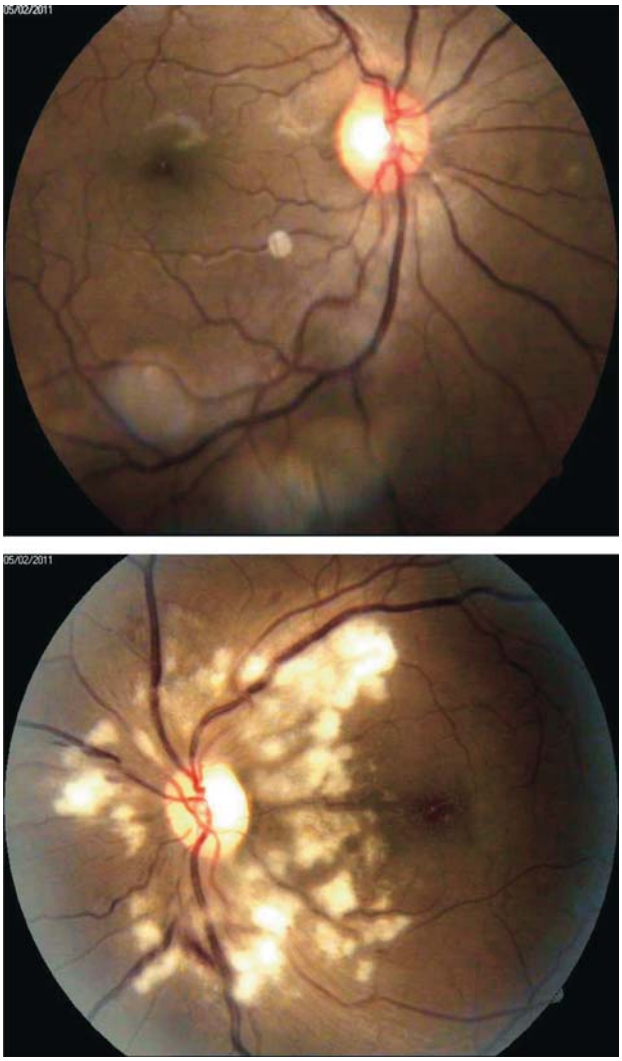


Figure 1 LE showing Purtscher's retinopathy
RE Normal fundus

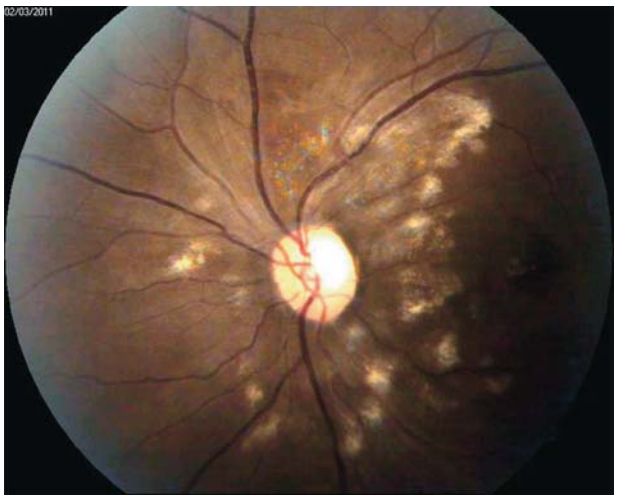


Figure 2 Resolving Purtscher's retinopathy at one month follow up

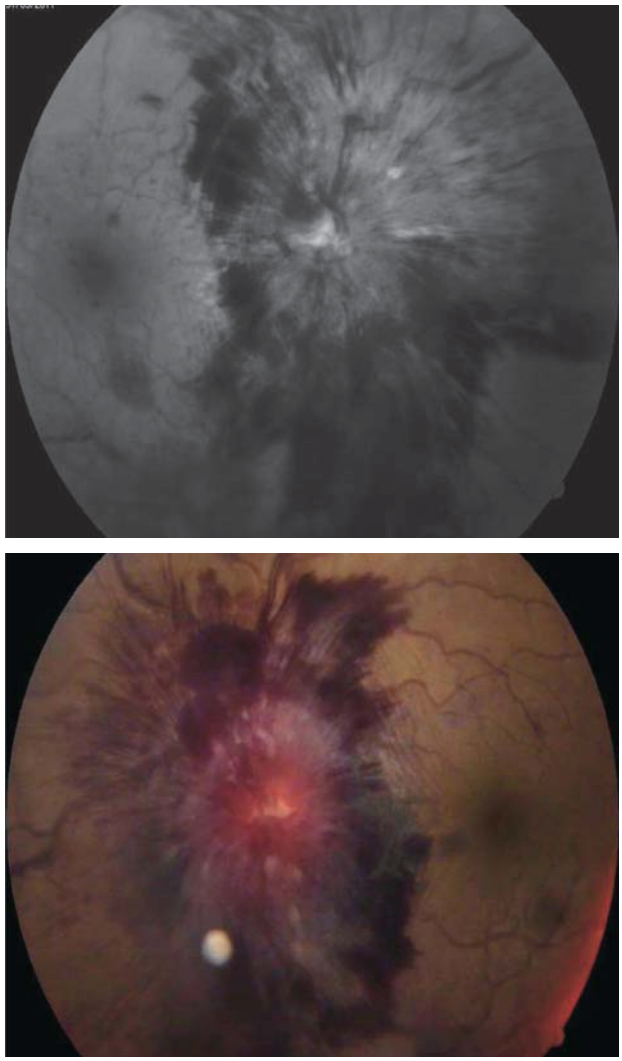


Figure 3 Terson's syndrome

capillary bed are known as Purtscher flecken. Optic nerve is typically normal but may be edematous or pale. Fluorescein angiography shows capillary non perfusion and late leakage from injured retinal vessels.[1, 2]

The exact pathophysiology is not known. It is hypothesised that the trauma generates an intravascular hydrostatic shock wave that is transmitted to the retinal vasculature. This acutely raised intraluminal pressure results in endothelial damage. Emboli of fat, air, amniotic fluid or complement mediated granulocyte aggregation can also cause occlusion of the peripapillary terminal arterioles supplying the superficial peripapillary capillary net.[3]

The most accepted pathogenesis is leukoembolization that causes arterial occlusion and infarction of the microvascular

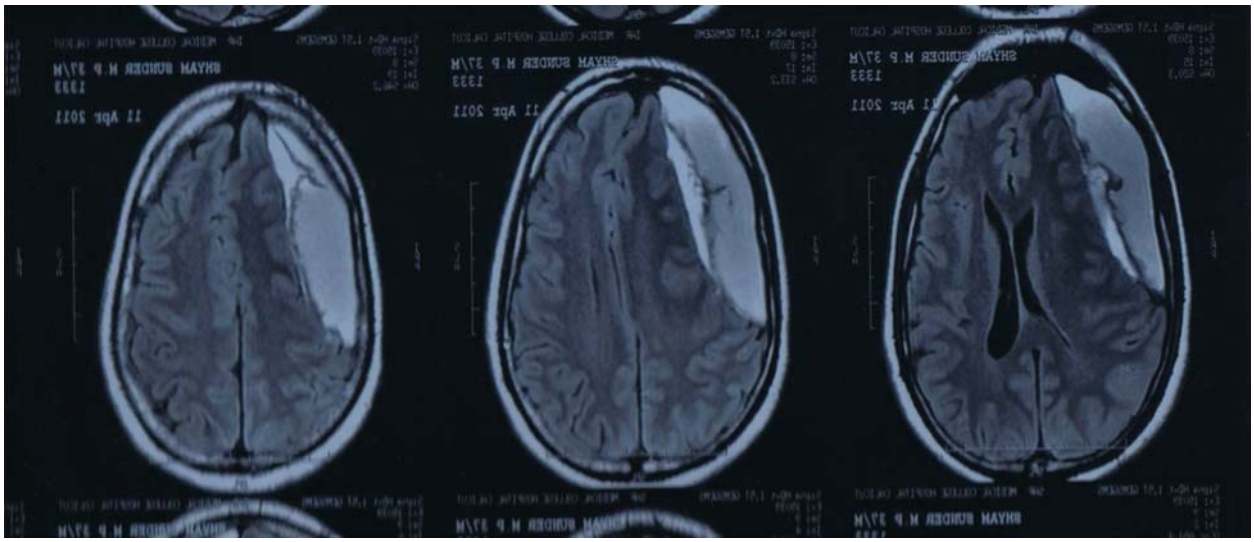


Figure 4 MRI showing a right subdural haematoma with midline shift and mass effect

bed. Leukocyte aggregation, induced by complement C5a, is the most likely mechanism of embolization because of its known association with trauma, acute pancreatitis, and vasculitic diseases.[4]

Within six weeks, the white retinal patches fade away and the fundus may appear normal, though there may be residual pigment mottling and optic atrophy. The majority of the patients recover useful vision of 6/12 or better unless the macular arterioles are involved when visual prognosis is generally poor. There is no definite treatment described.[1,2] Although some authorities advocate the use of systemic steroids there is no proof as to their efficacy. However the underlying trauma or systemic disease must be treated.

Terson's syndrome

An intraretinal hemorrhage associated with subarachnoid hemorrhage (SAH) was first described by the German ophthalmologist Moritz Litten in 1881. However this entity is known after the French ophthalmologist Albert Terson since his report in 1900.

Terson syndrome now encompasses any intraocular hemorrhage associated with any intracranial hemorrhage and elevated intracranial pressures. The intraocular hemorrhage is usually bilateral and superficial to the retina, the classic presentation being in the subhyaloid space(11-33%). But the bleed can be sub retinal, retinal, preretinal, subhyaloidal, or vitreal.

The sudden rise in intracranial pressure is the primary inciting event in Terson syndrome. Intracranial pressure is transmitted through the optic nerve sheath to the swollen optic nerve head. This occludes the retinal and choroidal



Figure 5 Terson's syndrome at one month follow up.

anastomoses at the level of the lamina cribrosa. The elevated venous pressure thus generated in the retinal venous system ruptures the retinal vessels, resulting in intraocular hemorrhages.

Visual acuity ranges from 20/20 to light perception, as related to the degree and extent of the intraocular hemorrhage. [5, 6, 7] Most cases clear spontaneously in 6-12 months. Long term visual prognosis is good in 80% of cases. Complications include elevated intra-ocular pressure, epiretinal membrane formation, retinal detachment and retinal folds. Persistent visual deficit is due to non resolving vitreous haemorrhage, retinal pigment epithelial disturbances or epiretinal membranes. Vitrectomy should be considered in patients who fail to improve.[8]

The neurologic symptoms are related to intracranial bleeding. Intraocular hemorrhages are associated with 20-40% of intracranial bleeds.[6,7] Though they commonly present in the acute setting of an intracranial haemorrhage, onset as late as 47days after the insult have been reported.[5]

In the current case report, a massive rebleed which has occurred after two and a half months of head injury has resulted in the Terson's syndrome. Mortality rate in SAH patients with vitreous haemorrhage is three to nine fold higher than in those without.[7]

To conclude, every case of trauma no matter however distant from the eye, presenting to the ophthalmologist should be comprehensively evaluated.

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Brief Report

Tilted Disc Syndrome

Dr Remya Mareen Paulose DNB, Dr Ashok Nataraj MS

CASE

A 53 years old male came with complaints of defective vision left eye of 2 years duration. His refraction showed right eye- -5.50 DS / -2.00 DC @ 160 dgrees 6/6 , near vision- +2.25DS J2, left eye- -6.00 DS / -2.25 DC @30 degrees 6/36, near vision +2.25 DS add J10.

Both eyes anterior segment was within normal limits. Both fundi showed tilted optic disc, with pigmentary changes in the peripapillary region surrounding the area of tilt, additionally left fundus had retinal pigment epithelial changes with subretinal fluid at the macula.
Diagnosis of both eyes tilted disc syndrome with left eye central serous retinopathy was made. The patient was subjected to optical coherence comography and fluoroscein angiography (Figure 1,2,3,4).

Focal laser was performed around area of leak. At subsequent follow-up visit, OCT showed reduction in the subretinal fluid at the fovea with RPE changes. The vision is now stabilized at 6/12, J4.The complete visual recovery was not attained in this case probably due to delayed presentation, thus resulting in irreversible changes to the RPE.

DISCUSSION

The tilted disc is a congenital anomaly of the optic nerve head. Other terms used to describe discs with a similar appearance are Fuchs's coloboma, congenital crescents, conus, dysversion of the optic nerve head, segmental hypoplasia and situs inversus.[1] It represents a classical optic nerve coloboma and, while there is no actual rotation of the optic disc, the disc appears more heaped up in the superior aspect due to the hollowing out of the inferior disc, following incomplete closure of the embryonic ocular fissure at six weeks' gestation. The other features include inferonasal crescent, myopia, myopic astigmatism, visual field defect, inferior staphyloma, and retinal pigment epithelium (RPE) atrophy.

In tilted disc syndrome the superior pole of the optic disc may appear elevated with posterior displacement of the inferior nasal disc, or the disc can be horizontally tilted, resulting in an oval-appearing optic disc with an obliquely oriented long axis. This condition is often accompanied by a scleral crescent located inferiorly or inferonasally, situs inversus (a nasal detour of the temporal retinal vessels as they emerge from the disc before turning back temporally), and posterior ectasia of the inferior nasal fundus. Many affected eyes are myopic. There can also be moderate-to-severe thinning of the retinal pigment epithelium, choroid and the sclera and this can result in choroidal neo-vascularisation.
Crescent is created by a disparity between the size of the retinal and scleral openings at the optic nerve head.

Pathogenesis

Tilted disc is presumably related to mal-closure of the embryonic optic fissure, although its basic cellular etiology remains speculative.[2]

Clinical Manifestations

Visual acuity

Amblyopia - The effect of tilted disc on visual acuity may begin when the visual system is developing during infancy leading on to amblyopia.

Myopia - The severity of myopia and the axial length of the eye have been correlated with the degree of optic disc tilt.[3]

Astigmatism- Astigmatism is present in as many as 93% of patients with tilted discs.[4]

Optic disc fatures- Usually the tilted disc appears either oval or D shaped with one hemisphere of the disc more elevated than the contralateral half. The orientation of the tilt is mostly inferonasal.
Retina- Retinal findings associated with tilted disc include peripapillary atrophy, chorioretinal atrophy and posterior staphyloma.[5,6]

Retinal vasculature- Situs inversus characterized by retinal vessels that exit the optic disc nasally before running temporally.[7]

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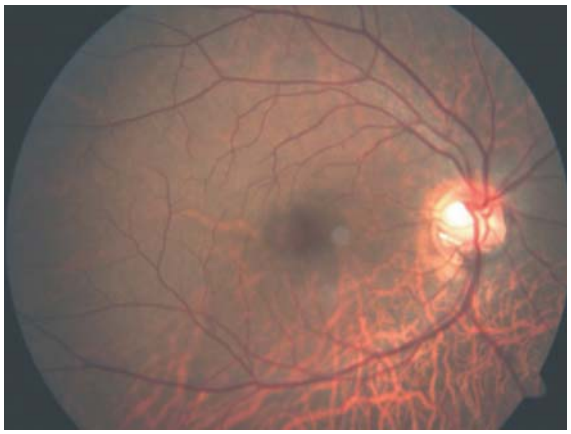


Fig 1 Fundus photo Right eye with tilted optic disc

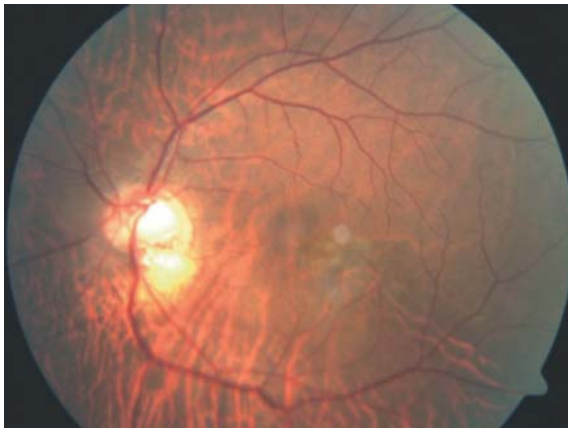


Fig 2 Fundus photo Left eye- Tilted optic disc , pigmentary changes along inferotemporal part of the disc with serous detachment at the macula.

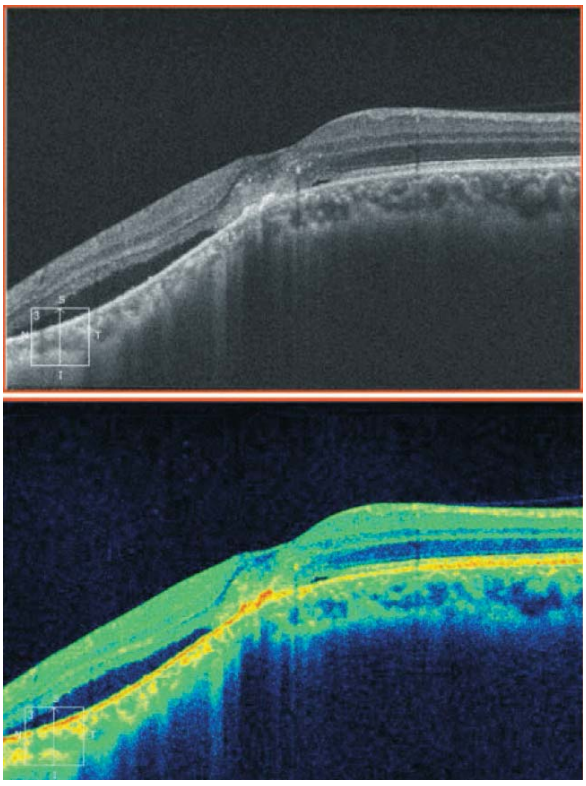


Fig 3 OCT Left eye showing subretinal fluid with RPE changes at fovea

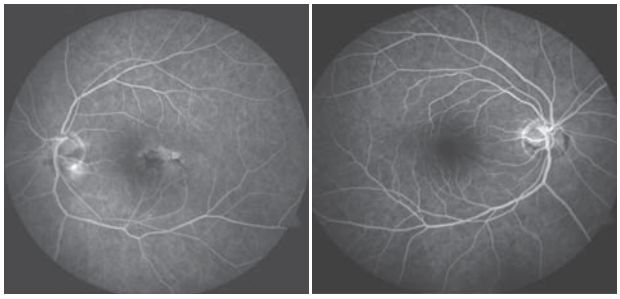


Fig 4 Fundus fluorescein angiography left eye showing focal leak in the inferotemporal part of the disc with no leaks in the parafoveal region. In the right eye there was no fluoroscein leak at the area of tilt.

Miscellaneous- A possible link between optic disc drusen and tilted discs has been reported.[8]

Tilted disk syndrome

The term tilted disk syndrome (TDS) refers to a combination of juxtapapillary changes and retinal vascular findings associated with inferonasally tilted discs

Visual field defects

Fuchs recognized that the most common location of a visual field defect in eyes with the tilted disc syndrome was the superior temporal quadrant.[9] However, although this quadrant is the most frequent location[10, 11] field defects may occur anywhere in the peripheral field, or even paracentrally.[10]

Visual field loss is typically a superior temporal defect as the coloboma affects the inferior nasal aspect of the optic disc. If tilted disc syndrome is bilateral, it causes a superior bi-temporal field defect similar to those caused by chiasmal compressive lesion – namely, pituitary adenoma, suprasellar masses. However, the field defect in tilted optic disc syndrome will cross the vertical midline due to the oblique insertion of the papilla into the globe, whereas a chiasmal field defect will not. Appropriate refractive correction often results in elimination of the visual field defect.

Color vision- Individuals with tilted disc syndrome may have a higher prevalence of color vision defects.

Retinal changes- Patients with tilted disc syndrome have been described with choroidal neovascularization[12], polypoidal choroidal vasculopathy,[13] peripapllary pseudocysts,[14] foveal retinal detachment and retinoschisis,[15]

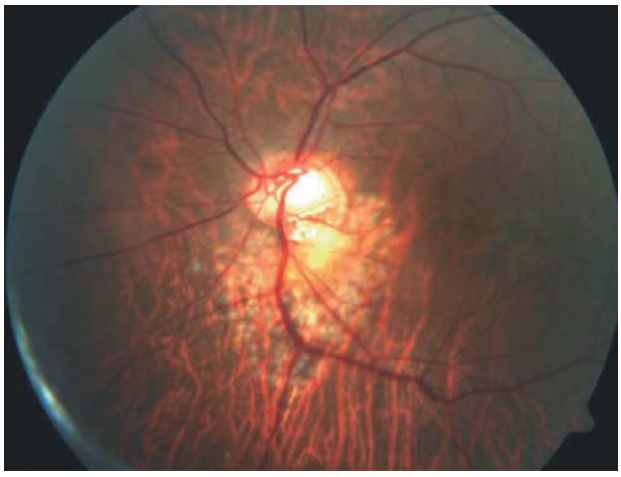


Fig 5 Laser Marks along inferotemporal region corresponding to the leak in FFA

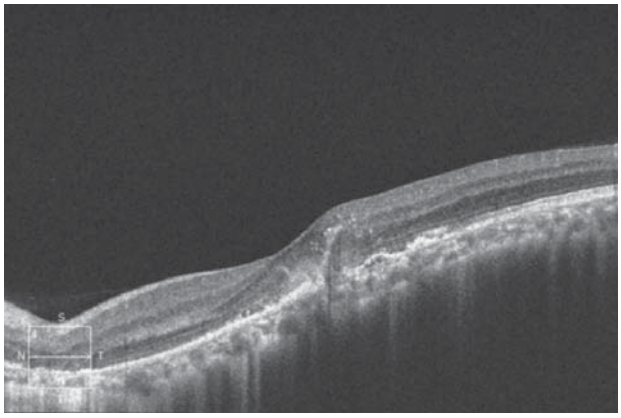


Fig 6 Repeat OCT at 2 weeks after laser treatment showing resolution of edema and RPE changes at fovea

serous sensory retinal detachment,[16]chorioretinal degeneration,[17] and chorioretinal folds.[18]

Systemic association - Several studies have described an association between tilted disc syndrome and CNS disease-like tumours such as craniopharyngioma, craniosynosthosis and Ehlers-Danlos disease, so CT and/or an MRI scan would be useful.

Differential diagnosis

A. Temporal myopic crescents

B. Secondary segmental hypoplasia of the optic nerve

C. Papilledema and other causes of optic disc elevation

D. Neoplasias of the optic nerve and optic nerve head (Glioma, meningioma)

E. Glaucoma with peripapillary atrophy

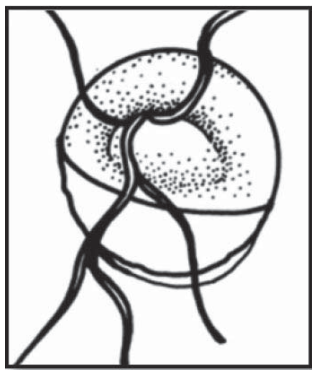


Fig 7 The incongruity between the D-shaped sclera canal (stippled) and the circular retinal opening forms the crescent

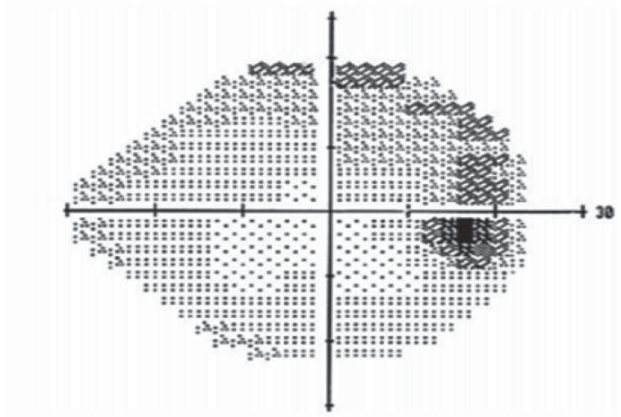


Fig 8 Superior temporal crescent corresponding to classic pattern of tilted disc.

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PG Tear Sheet

Functional Vision: What else do we need to do?

Dr. V. K. P. Geetha DNB, Dr. S. R. Rathinam DO, DNB, PhD

Introduction

The term vision encompasses the complexities of shape, size, color, contrast, stereopsis, and movement across the vast visual fields of both eyes[1]. Visual acuity defines the smallest spatial detail that can be resolved for high contrast stimuli but it does not specify the responses of the visual system to objects of different size and contrast. Even a normal person can have difficulty in real life situations like driving on a rainy night or reading highway signs. Such problems lead to the new term 'functional vision'[2]. It is a person's ability to integrate the components of vision effectively to accomplish day to day visual tasks. Here we would like to discuss the physiology of functional vision and role of tests for functional vision like contrast sensitivity and glare disability in the assessment of quality of vision.

Until recently the only device employed to assess the visual function was Snellen visual acuity charts. This employs high contrast familiar letter optotypes. As such it is a measure of the optical resolving power of the eye. It is performed under controlled lighting conditions generally darkened and therefore doesn't simulate the varied visual challenges of daily life. Some patients may complain of diminished functional vision even though good Snellen acuity may be maintained; e.g. very bright light or dim light. These real life situations present a far more complex series of visual clues to interpret than does Snellen charts. So there has been an increased interest for the development of additional tests for assessing functional vision. Evaluation of functional vision includes contrast sensitivity and glare disability.

Contrast sensitivity

The variation in brightness of an object is characterized by a quantity called contrast[3]. The contrast of an object is defined as the difference in luminance of a target against the background[3,4];

i.e. $I_{min} = \frac{I_{min}}{I_{max}} + I_{min}$ where I_{max} is the maximum brightness and I_{min} is the minimum brightness. The minimum resolvable contrast is the contrast threshold. The reciprocal of the contrast threshold is defined as contrast sensitivity[3, 4]. The manner in which contrast sensitivity changes as a function of spatial frequency of the targets is called contrast sensitivity function[3, 4] (CSF).

Contrast sensitivity function evaluates patient's ability to see fine details at differing contrasts relative to the background. Contrast sensitivity testing is analogous to audiometry where hearing threshold sensitivity to audible tones of differing intensities and audio frequencies[2]. Snellen visual acuity which is performed only at high contrast is similar to audiometry performed at only one volume or like listening to music in which all notes are played at maximum volume[2].

In Snellen acuity testing, the 20/20 optotype subtends a total 5' of arc on the retina, with each arm and each space accounting for 1'. A contrast grating pattern correlates to the arm and space of the letter E. 1 dark bar and 1 light bar constitutes 1 cycle[2].



Figure 1. One cycle in Contrast grating pattern

To convert Snellen acuity into spatial frequency (cycles/deg) the denominator is divided by 600 (180); e.g. 20/20 (6/6) = 3 cpd; i.e. 600/20 or 180/6. It follows that just at that point 30 cycles/degree on a contrast sensitivity curve at high contrast correspond to 20/20 line of Snellen acuity chart[2].

The typical human contrast sensitivity curve reveals that the peak contrast sensitivity of the visual system occurs at image size near 6 cycles/degree as subtended on the retina[2]. An object that subtends 6 cycles/degree on the

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retina corresponds in size to a 20/100 (6/30) optotype. This indicates that human visual system requires higher contrast, for perception at higher spatial frequencies. Therefore it is possible that the eye may perceive small target size at high contrast while not recognizing large objects at reduced contrast levels. This concept offers an explanation for the visual complaints of patients who retain reasonably good Snellen acuity yet express difficulty in real life visual function.

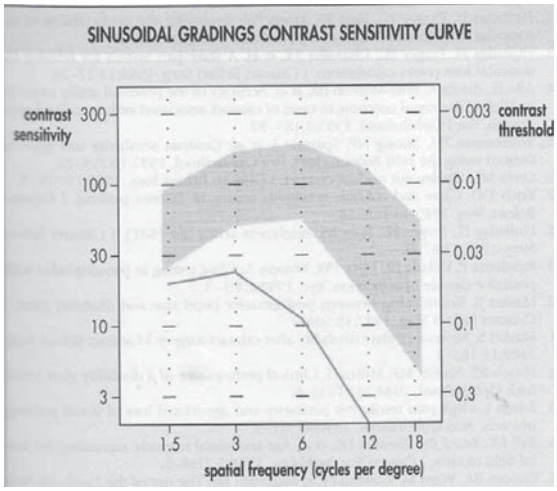


Figure 2. A typical contra sensitivity curve. The shaded area represents the range of normal values.

Physiology of contrast sensitivity

The recognition of contrast begins at bipolar cell level. Receptive field of a retinal neuron is that portion of visible world in which light can stimulate that cell. The receptive fields of bipolar cells are doughnut shaped with an excitatory response in the centre and inhibitory centre in the surround (on centre cells) or vice versa (off centre cells)[5]. This results from confluence of bipolar cells and horizontal cells synaptic processes at the base of the photoreceptor. The central portion determined by photoreceptors which feed directly onto the bipolar cell. The surround is determined by horizontal cells and their synaptic endings which are inhibitory to photoreceptors – bipolar cell transmission.

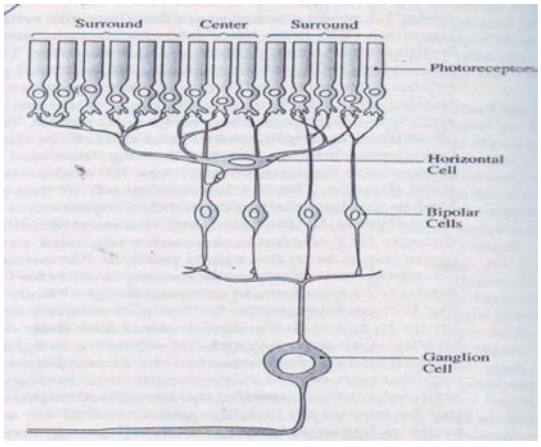


Figure 3. Simplified diagram of retinal circuitry showing how center-surround receptive fields are generated in bipolar cells. The excitatory center represents direct inputs from overlying photo receptors, and the surround represents inhibitory inputs from horizontal cells that have synaptic connections with more distant photo receptors.

Light that evenly covers both centre surround of bipolar cell receptor field is not an effective stimulus as the centre and surround regions offset each other. An edge crossing the receptive field will stimulate only part of the surround and this creates an imbalance that is a powerful stimulus to the cell. Because of adaptation, it is also necessary that these edges sweep continuously across the retina to maintain activation of the neurons. This centre surround contrast sensitive organization of bipolar cell is passed on to the ganglion cells and eventually to cortical neurons[5].

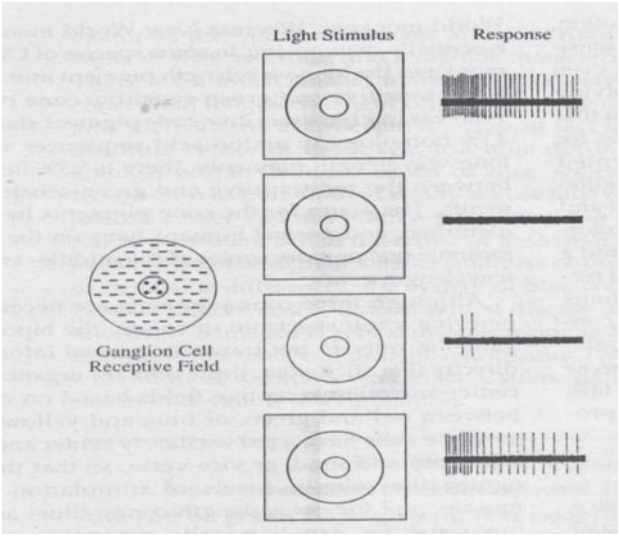


Figure 4. Diagram of Ganglion Cell receptive fields showing why edges and contrasts are critical to vision. The cell is activated by simulation of the center area and inhibited by simulation of the surround area but it responds only minimally to diffused light because the center and surround offset each other.

This means that our eyes are exquisitely sensitive to edges and differences in brightness but are relatively insensitive to steady illumination. We see objects by borders and brain fill in the centre if there is no new pattern to create a stimulus. This accounts for many illusions of brightness; e.g. at the junction between 2 levels of grey, we tend to perceive an extra band of darkness on the dark side and an extra band of brightness on the lighter side. These are called Mach bands and are involuntary perceptions[5]. A gray circle on white background appears darker whereas same in black appear brighter.

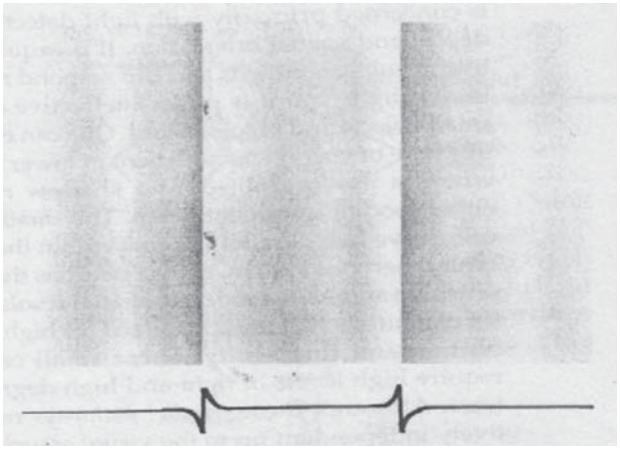


Figure 5. Illusion of darkness and brightness produced by the presence of Mach bands. The line beneath the shaded figure shows the relative brightness at each point. Each of the three regions is equally bright, except at the junction. The center area appears lighter because of a light – to – dark junction on either side of it.

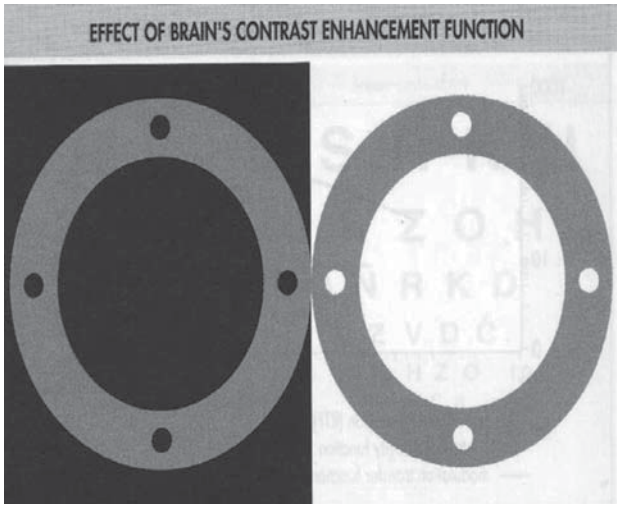


Figure 6. Effect of brain contrast enhancement function. One Gray cycle is seen against a black background and one against a white background. Here the gray looks lighter against the dark background and darker against the light background[6].

Variations in contrast sensitivity

Physiological

CSF decreases with age beginning around 40 years of age[6] for which two factors are responsible. Crystalline lens scatters more light with increasing age which blurs the edge of targets and degrades the contrast. (Negative spherical aberrations of lens cancel the positive spherical aberrations of cornea) Retina brain processing system itself loses its ability to enhance contrast with increasing age. Ganglion cells in retina are major determinants of contrast sensitivity and we gradually loose these cells as age advances.

Pathological

CSF reduces at high spatial frequencies when visual acuty is reduced for any reason including uncorrected refractive error, keratoconus etc. CSF is quite sensitive but not as specific as glare disability testing, when evaluating cataract[2]. Early cataract decreases contrast sensitivity primarily at high and intermediate frequencies[2,7,8] whereas optic neuropathies reduces contrast sensitivity at low frequencies. In cataract patients contrast sensitivity is reduced by glare to a greater extent than normal people[9]. Cortical cataract were most affected followed by posterior subcapsular cataract[9:13] Reduced contrast sensitivity is also seen in age related macular degeneration ' diabetic retinopathy and dry eye syndrome[14].

Effect of monocular cataract on binocular visual function

Binocular contrast sensitivity decreases a level below that of the cataractous eye alone[2,15]. This suggests that correcting only one eye in a patient with bilateral cataract, may not fully improve functional vision. Often the second eye requires surgery for the patient to get benefits of cataract rehabilitation.

Contrast sensitivity testing

While testing CSF best possible optical correction should be given. Luminance must be kept constant at 30-70 foot lamberts. Pupil size has an effect on CSF. With miotic pupil, diffraction reduces CSF. With large pupil, optical aberration may interfere.

Contrast sensitivity (CS) testing is usually supplementary to visual acuty determination in diseases like cataract[16] It is also useful in occupational evaluation of people for tasks where small low contrast objects are important[17].

Currently the familiar letter optotype contrast charts designed by Pelly Robson and Regan are used as clinical alternatives to sine wave gratings.

Regan charts employ logmar optotypes between 20/200 and 20/20 at varying contrasts of 95%, 50%, 25%, and 4%. Since the Regan charts present letter targets of differing size at varied contrasts, they can be used to establish a true CSF curve for the eye[2].

In contrast Pelly Robson charts offer only one size of letter targets that vary in contrast[2]. It attempts to evaluate the most

sensitive part of the CS curve near 6 cycles/deg. Without targets of varied sizes, a complete contrast curve for the eye cannot be determined. In this chart letters subtend an angle of 3 degrees at a distance of 1 meter. The letters on chart are organized as triplets there being 2 triplets in each line. The contrast decreases from one triplet to the next. Chart is hung on the wall and illuminated uniformly and subject sits in front of the chart at a distance of 1 meter. CS is indicated by the finest triplet named correctly. This

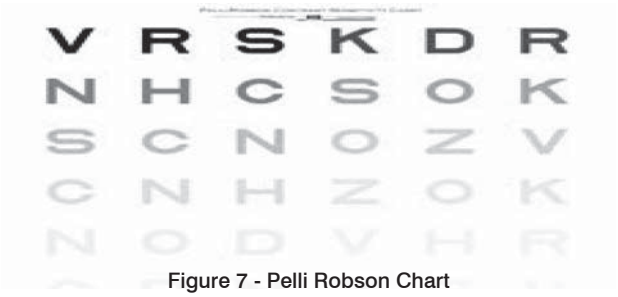


Figure 7 - Pelli Robson Chart

method is highly reproducible[10].

Glare disability

Glare disability is the subjective visual response to ambient light. Disability glare has been described as a reduction of retinal image contrast as a result of intraocular light scatter due to inhomogenisity of the ocular media; e.g. cataract[2]. A second type of glare in the absence of significant ocular disease is discomfort glare; e.g. after leaving dark room, bright light may induce discomfort glare prior to retinal photic adaptation[2].

It is the reduction in visual function caused by scattering of the incoming light by inhomogenesity of the ocular media[2] e.g. cataract. Disorders of anterior segment causes glare disability, where as disorders of posterior segment will not cause. The closer the media opacity to the retinal image plane, the lesser the opportunity for light scattering. Cataracts disperse incoming light and are anterior in the path of light. Therefore such patients exhibit marked glare disability, while retaining good visual acuity under favorable lighting conditions. Cortical and posterior sub-capsular cataracts generally cause daytime glare[18], whereas nuclear cataracts are more prone for night time glare. Contrast sensitivity of an ideal observer is apparently reduced corresponding to the loss of retinal contrast because of the glare source.

Several devices for detecting glare disability are employed. These are generally devised to test a function of vision with and without addition of an offending light or glare source. The difference in visual function with and without glare source is attributed to glare disability.

However each testing system uses a different glare source (central/peripheral point light source/diffuse background illumination and so on) and different tests of visual function (letter opto types, sine wave gratings, Landolt's ring etc).

The Brightness Acuity Tester (BAT)

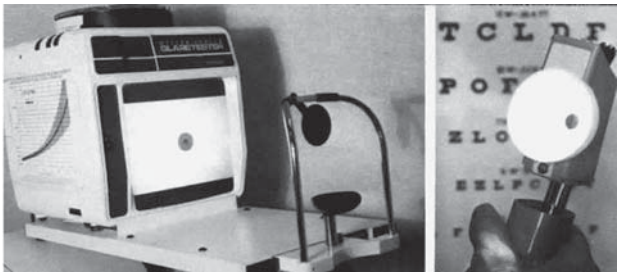
The Brightness Acuity Tester (BAT) is in common use because it is readily portable, compact, and relatively inexpensive and may be used in conjunction with Snellen chart. It offers 3 levels of background illumination in a small hemispheric bowl held near the eye.

Disadvantages

1. One possible source of error is pupil constriction by the illuminator. Certain patients with cataract perform better with pupil constriction, thereby giving a false negative result.
2. Conversely the third level of brightness is dazzling inducing false positive results
3. No point source is used in this and BAT does not stimulate night driving conditions

Miller Nadler glare testing device

This unit uses a modified table top slide projector to provide diffuse background illumination against which the patient views one of a series of landolt's rings that sit on a constant background circle. The rings in contrast to the background glare with a contrast test, may be useful in simulating day time glare disability. But this system offers only one object size[2]. Miller Nadler glare testing device poorly detects and measures subtle changes in ocular media such as early



(a) (b)

Figure 8. (a) Miller- Nadler glare testing device (b) Brightness acuity testing device

cataract[19].

Other Automated devices like eye con 5 (background)) IRASGT (four point) MCT 8000 (points or background) TVA (point source) have been developed and marketed.

Simple, non calibrated methods are also available. One is to measure Snellen acuity indoors and then retest the patient outdoors with chart positioned in front of direct sunlight.

Another method is to direct a penlight obliquely towards

the pupillary margin while Snellen acuity is underway. This difference between Snellen acuity with and without the penlight is attributed to glare disability.

No uniform standards have been established for glare testing and this limits its acceptance by rigid scientific criteria. It correlates well with cataract symptoms and is reversible with cataract surgery. Visual acuity is predictive of contrast sensitivity but a poor predictor of glare[20, 21]. We can hope that standard means for combining glare and contrast sensitivity will soon be established.

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Dr. Sanitha Sathyan DNB, Dr. Meena C.K DNB, Dr. Elizabeth Joseph MS

12 year old male, presented with unaided visual acuity of 1/60 in both eyes. Relevant History: Preterm birth at 32 weeks of gestation, second of twin (twin brother died 2 days after birth). Surgical correction of inguinal hernia done at 4 years of age. General examination: short stature, coarse facial features, prominent forehead, large tongue, hoarseness, nasal breathing, abnormal gait. Mild mental retardation (Intelligence Quotient: 66). Systemic features: dysostosis multiplex, pectus carinatum, lumbar lordosis and scoliosis, , hepatosplenomegaly. Respiratory system evaluation: Restrictive lung disease with major restriction in pulmonary function test with respiratory and metabolic acidosis in arterial blood gas analysis. ENT evaluation: no evidence of deafness. Ophthalmic features: small palpebral fissures with epicanthal folds. Cornea showed uniform haze with discrete deposits in the stroma. Disc, macula and intraocular pressure were normal. Central corneal thickness was increased (Right eye: 670 microns. Left eye: 666 microns). Features are consistent with Mucopolysaccharidosis-Hurler's disease.It is important to have a detailed general and systemic examination in children presenting with corneal pathology as it maybe a part of a multisystem disorder.



Clinical photograph showing characteristic facies:



Photograph showing epicanthic folds, corneal haze





Photographs showing pectus carinatum, lordosis and scoliosis

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Dr. Meenu C. Jacob DO

Intracameral recombinant tissue plasminogen activator for refractory toxic anterior segment syndrome(TASS)

Br J Ophthalmol. 2014 Feb;98(2):252-5.

Asaf Dotan, Igor Kaiserman , Israel Kremer, Rita Ehrilch, Iret Bahar

Aim of the study was to investigate the efficacy of intracameral recombinant–tissue plasminogen activator(r-tPA) injection in the management of refractory TASS after cataract extraction surgery.

This was a prospective cohort study that included 40 eyes of 40 consecutive patients with an inflammatory fibrinous reaction in the anterior chamber after cataract surgery with PCIOL implantation who failed to respond to conventional treatment with intensive topical and sub- conjunctival steroids

r– tPA preparation was diluted under sterile condition to a concentration of 25 mirogram /0.1 ml.and 0.1 ml of r- tPA was injected intracamerally using 30 G needle. Mean interval of injection from surgery was 20.3 ± 9.6 days. Patients were evaluated for fibrin reaction or complication at day 1, one week and one month following r-tPA injection and findings compared with baseline values.

At 1 day after injection, the fibrinous membrane in the anterior chamber was completely dissolved in 60% (32patients) and partially dissolved in 20% (8 patients). At 1 month, the fibrinous membrane was completely dissolved in 95%(38patients).

The mean visual acuity improved from 0.61 ± 0.38 logmar before treatment to 0.45 ± 0.37 logmar one month later (p= 0.06) . There were no cases of increased IOP or endophthalmitis following the procedure. Mean endothelial count was measured before and after injection and no significant cell loss was demonstrated.

Present study shows that 25 microgram r – tPA is safe and effective for the treatment of refractory fibrin reaction after cataract surgery, as it hastens fibrin absorption and may help to avoid complication associated with long standing intraocular inflammation

Injection frequency and response to bevacizumab monotheapy for diabetic macular edema (BOLT 5 report)

Br J Ophthalmol. 2013 Sep;97(9):1177-80

Sobha Sivaprasad , Roxanne Crosby Nwaobi , Ling Zhi Heng , Tunde Peto , Michel Michaelide , Phil Hykin

Aim of the study was to explore the parameters that influence the injection frequency in patients treated with intravitreal bevacizumab for diabetic macula edema(DME). Study was done as a post HOC analysis of BOLT study (prospective randomized control 2 year trial that compared repeated intravitreal bevacizumab(IVB) or laser therapy in 80 patients with persistent central involving DME after at least one prior laser treatment.

In this analysis, patients in IVB arm of BOLT study was included. BCVA in the study eye was Snellen equivalent of >6/60 or <6/12 and centre involving DME of >270 microns. Patients received three mandatory intravitreal bevacizumab injection 6 weekly followed by OCT guided retreatment protocol until stable central macular thickness (CMT) is achieved, (three consecutive CMT within 20 microns of patients thinnest recorded CMT). Patients could thereby receive a minimum of 3 injections and maximum of 9 injections in first 12 months. Patients were followed up and treated using the same criteria for 24 months.

Injection frequency at 1 year (< or >6), 2 yrs (< or >3), response profile (i.e whether dry) of the patients at 4 months (early responder), 1 year (intermediate responder), 2 years (late responder) and non responder were analyzed. Macular phenotype of DME was classified as diffuse retinal thickening, cystoid macular edema(CME) and subretinal detachment(SRD)

21.6% of patients were early responders, 5.4% intermediate responders and 21.6% late responders. There were 56.7% patients classified as non responders. None of the patients with SRD had dry macula at 12 or 24 months following intensive treatment indicating that it may be worth considering other treatment options for these cases.

Most of the patients who were dry by 4 months (87.5%) remained dry at 12 and 24 months. In contrast, those

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who had edema at 4 months had persistent edema at 12 months. However, approximately 20% of the late responders achieved dry macula at 24 months with sustained treatment.

Statistically significant visual outcome i.e improvement of 15 or more letters was seen in late responders compared to any other type of responder suggesting that edema at 4 or 12 months should not be used as a stopping criteria for treatment. Vision continues to improve in the 2nd year.

Analysis of the data who completed 2 year follow up showed that none of the baseline characteristics evaluated in the study were found to significantly determine the persistence or recurrence of edema and thereby injection frequency in the first year. However, in the second year, eyes with better baseline visual acuity required fewer injections. Eyes with SRD required more injections than diffuse and cystoid macular odema.

Observations in the study will help guide, clinicians managing patients with DME, including factors to consider in deciding when to continue or stop intravitreal therapy. However this study also illustrate the need for further investigations into relationship between baseline visual acuity and more detailed ultrastructural features of DME and in addition the impact of these features on the recurrence or persistence of odema

Analysis of tear cytokines in sjogren syndrome dry eye patients and non- sjogren syndrome dry eye patients

Am J Ophthalmol. 2013 Aug;156(2):247-53

Sang Yeop Lee, Sou Jung Han, Sang Min Nam , Sang Chul Yoon, Ji Min Ahn, Tae Im Kim et al

Aim of the study was to compare concentration of tear cytokines in Sjogren syndrome (SS) dry eye, non Sjogren syndrome (non SS) dry eye and normal subjects and to correlate the tear cytokines with ocular surface parameters.

This was a prospective cross sectional study and analysed the level of inflammatory cytokines in tears. Forty eyes of 24 SS dry eye patients, 40 eyes of 25 non SS dry eye patients and thirty five eyes of 21 normal subjects were enrolled in the study. To evaluate the ocular surface symptoms, the authors examined tear break up time(TBUT), Schirmer test, corneal and conjunctival staining grade and ocular surface disease index (OSDI) in all patients and normal subjects.

Tear concentrations of IL-17, IL-6, IL-10, IL-4 ,IL-2, IFN – gamma and TNF alpha were measured using a multiplex immunobead assay and flow cytometry.

All the mean concentrations of tear cytokines in the SS dry eye groups were higher than those of the two other groups. The mean concentration of IL–17, TNF alpha, IL -10, IL–6 and IL–4 in the SS dry eye group were significantly greater than those in control group. Between two dry groups mean concentrations of IL–17, TNF alpha, IL–6, IL–4, and IL–2 were significantly different.

Ocular surface parameters were correlated with cytokines and IL–17 and TNF alpha showed significant correlation with ocular surface parameters in SS dry eye group. IL–17 showed significant correlation with TBUT and Schirmer test 1 and TNF alpha was only significantly correlated with Schirmer test 1 . In non SS dry eye group only TBUT and IL–6 were significantly correlated.

The difference in cytokine levels and correlation patterns in each dry eye group in the study shows the possibility of different inflammatory process according to dry eye type. It can be presumed that SS dry eye may be affected by systemic or local immunologic reaction related to IL–17, while non SS dry eye may be related to stressful situations which can induce increase in cytokines like IL–6. The study results of IL–17 in SS dry eye group supports the possibility of a T cell specific therapy or immuno modulatory treatment for SS dry eye

Text book of OPHTHALMOLOGY with DVD ROM

Author: Prof. H V Nema
Prof. Nitin Nema
Publisher: Jaypee Brother Medical Publisher P LTD.
New delhi
Sixth edition 2013, 668pages, price Rs 850/-

In spite of introduction of modern audio - visual techniques: projection slides and television tapes, the bedrock of undergraduate education in ophthalmology remains the standard textbooks. The need for a new and updated text book is strongly felt with rapid developments and achievements in ophthalmic science

A thorough knowledge of ocular anatomy and physiology is essential for a proper understanding of ophthalmology. Hence, general anatomy and physiology of the eye and its individual structures are comprehensively dealt with.

The reader may find the chapter on Examination on the Eye informative and interesting as all the routine advanced clinical methods with diagnostic techniques in ophthalmology are incorporated in brevity.

In the present edition, all chapters have been updated, and the chapters on Physiology of the Eye, Ocular Manifestations of Disease of the Central Nervous System, and Ocular manifestations Systemic Disorders have been completely rewritten. The general format of the book is slightly changed by incorporating surgery with individual disease entity, and a new chapter on Cryotherapy and Laser Therapy is included.

Like earlier editions, each chapter covers common eye diseases, their clinical features diagnostic tests, differential diagnosis, complications, and treatment. Almost all chapters are profusely illustrated with colored clinical photographs and drawings. Additional material is added to cover newer clinical entities, diagnostic procedures and therapeutic and surgical modalities of treatment of eye disease. However, no attempt has been made to present ambiguities and controversies in ophthalmology. The book has retained its original virtues of accuracy, clarity, comprehensiveness and consistency of style.

Keeping in view of the popular demand from medical students and teachers, an exhaustive chapter 31 on practical ophthalmology is included. The chapter consists of four parts: (1) Clinical long and short cases with discussions, (2) Dark – room examination with questions and answers, (3) Ophthalmic instruments and their uses, and (4) General viva voce. The chapter will make the students familiar with the modus operandi of under graduate practical examination in ophthalmology. Additionally, it will help in quick revision of the subject.

A brief description of local ocular anesthesia is given in chapter 32, and chapter 33 contains drawing, description, uses and methods of sterilization of ophthalmic instruments. Steps of common eye surgeries are demonstrated with the help of video clips. Observation of these video clips will help students to understand and learn fascinating ophthalmic surgeries.

At the end of each chapter, a few important references are given to enable inquisitive students to gather more information on the particular topic of interest.

This book contains a DVD – ROM which shows steps of 29 common ocular operative procedures.

The unique feature of this edition is chapter 31: Practical Ophthalmology. It covers all aspects of practical examination in ophthalmology – long cases, short cases, dark room examination, instrument, and viva voce. It will provide immense confidence to the examination going students.

There are approximately 1000 questions and answers which help in quick review and revision of the entire subject of ophthalmology.

The book is written mainly for the use of undergraduate medical students primarily keeping in mind their basic examination requirements. Hopefully, it will also be beneficial to the post graduate students and residents in ophthalmology. The family practitioners, internists, neurologists and practicing general ophthalmologists can use it as a reference book in their day to day care of patients.

Dr. C.V. Andrews Kakkanatt
Jubilee Mission Hospital, Thrissur

Gass' Atlas of Macular Diseases edited by Anita Agarwal

5th edition

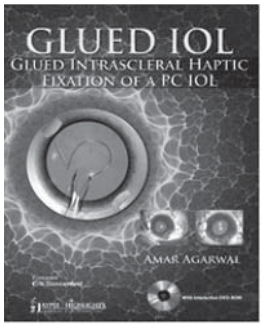
The Gass Atlas is a good compilation of both common as well as rare retinal and macular diseases all around the world. It consists of total 15 chapters ,beginning with normal anatomy and various imaging as well as electrophysiological techniques and is followed by a wide variety of chapters describing various infectious, degenerative and dystrophic conditions under different headings. Each chapter has an expandable table of contents with individual conditions as subchapters for easy identification. A descriptive, illustrative approach is followed in each chapter with colour fundus photographs supported by histopathological images along with various imaging modailities like optical coherence tomography(OCT),fundus fluorescein angiography (FFA) , indocyanine green(ICG) ,fundus autofluorescence and ultrasound B scan for better understanding of the clinical conditions. The cases also include follow ups to shows the disease progress or resolution. Though it is mainly an atlas of macular diseases, it also includes retinal and optic nerve conditions which mimick macular diseases, thus covering a wide range of macular conditions.

In the 5th edition, exhaustive chapters from the previous editions have been rearranged under different headings for better readability. Updates on infectious diseases like tuberculosis, syphilis and additional chapters on leptospirosis, chikungunya, dengue have been included. Newer diagnostic entities like acute idiopathic maculopathy and persistent and relentless placoid pigment epitheliopathy have also been added.

The atlas gives a good description of the clinical features ,the pathogenesis and the genetics of each disease but does not give any information regarding the management of the various conditions and is not intended to be a textbook with a vast bibliography. It mainly serves as an excellent clinical guide to ophthalmologists world wide in diagnosis of various conditions especially the rare ones,based on the wide range of fundus images and the ancillary diagnostic images provided.

Dr. Mahesh G
Dr. Bindhu Appukuttan
Giridhar Eye Institute, Kochi

Glued IOL: Glued Intrascleral Haptic Fixation of a PC IOL



Author : Amar Agarwal
Edition : First
Publishing Year : 2013
Pages : 214
Price: Rs. 1895.00

This book (with DVD) presents a detailed overview of a surgical innovation pioneered by the author himself. The book provides a comprehensive analysis of the use of fibrin glue to facilitate intrascleral haptic fixation of a posterior chamber IOL. The foreword by Eric Donnenfeld (New York University) describes how Agarwal's expertise and persistent creativity led to the use of fibrin glue for implanting an intraocular lens in patients without adequate support for a posterior chamber IOL - a most welcome option to the difficulties of suturing in this situation.

It is divided into four sections: Basic, Surgical technique, Special conditions and Miscellaneous. Beginning with an introduction, the following chapters describe different surgical processes for glued IOL, for both common and less common conditions. The final section examines complications and imaging, and compares the techniques and results of glued IOLs and sutured IOLs. With contributions from recognised ophthalmic surgeons in the UK, USA, Canada and Asia, this book features more than 460 colour photos and illustrations. A DVD demonstrating glued IOL surgical procedures is included.

Dr. Anju S Raju
Little Flower Hospital, Angamaly.

The cover photo in the last issue was HD OCT pictures of choridal osteoma
Courtesy: Dr. Mahesh G., Dr. Rameez Hussain, Giridhar Eye Institute, Cochin

Dear editor

We read KJO with great interest and would like to bring into notice some of the flaws in the articles. This is a general letter regarding the articles. The references in the articles are most often prepared without any guidelines. Sometimes the author just copies and pastes the references from internet. There are guidelines for publishing references. It is important in future when the journal gets indexed. Quoting the references leads to increase in impact factor. The following is an illustrated example taken from Indian journal of ophthalmology. I feel we should also strictly follow the same pattern

For articles

Singh JK, Bawa M, Kanojia RP, Ghai B, Menon P, Rao KL, Idiopathic Simulatenous intussuceptions in a neonate. Pediatr Surg Int 2009;25:445-47.

1.Authors in correct sequence, and names checked from PubMed . If more than six put et al.
2.Correct title of the article to come after the authors name
3.Correct journal abbreviation as given in Pubmed
4.Year of the article given after the journal abbreviation
5. Year of publication is followed by the volume no.
6. Page no comes last this should not be written as 445-447
7. Note . after name of article ; year : volume and page numbers

Miyano T, Kobayashi H, Chen SC. Long term results of biliary atresia. In: Gupta DK, editor. Text Book of Neonatal Surgery, 1st ed. New Delhi: Modern Publishers; 2000. p. 288-91.

1.Authors of the chapter
2. Title of the chapter
3. Chief Editor of the book
4. Name of the book
5. Edition no
6. City of publication
7. Name of publisher
8. Year and page no

There are tools in the Indian Journal of Ophthalmology site for Checking the correct reference

I urge all the authors to strictly adhere to these guidelines so that editorial process becomes easy

Dr Mahesh G
Past Editor KJO

Dear Editor

The March edition of Kerala Journal of Ophthalmology was excellent. The volume covered all sub specialties.

I would like to specially congratulate Dr Sujith V Nayanar for his article "Diagnostic Challenge Refractive surgical problem .The article was well written and informative.

CTK, DLK and corneal melt are rare but every refractive surgeon should be prepared to face these complications. The article had given an outline about the presentation and differential diagnosis. The discussion by prominent national faculties are valuable in managing complications associated with refractive surgery. It is important to rule out systemic diseases like rheumatoid arthritis, SLE or Sjojgrens syndrome where LASIK may be and inducing factor for cornel flap melt. This emphasizes the screening for dry eye in pre op work up for LASIK. The use of fluoroquinolones can play a role in progression of the melt.

I hope future issues will include similar interesting discussions about challenging cases
Regards,

Dr David Pudukadan
Consultant, Cornea Surgeon
Little Flower Hospital, Angamaly

Authors reply

Dear editor,

I appreciate Dr David Pudukadan's comments and thank him for showing interest in my article. The asymmetric unilateral pattern of presentation and no past or present history to suggest collagen vascular diseases kept us away from considering systemic causes for this anomalous behavior. Still the possibility was ruled at a later stage as mentioned in the report. Role of fluoroquinolones in corneal melt is very well taken but doesn't seem to be the triggering factor in our case atleast where DLK stage 4 and epithelial ingrowth was already predominant and also because the patient tolerated it very well in the fellow eye.

Dr. Sujith V. Nayanar
Vasan Eye Care
Calicut

Dear Editor

At the outset let me congratulate the editorial team for bringing out a comprehensive issue; starting from mere basics which is of great value to the post graduates; to the recent advances in Ophthalmology.

Advances in cataract surgery have always been in the forefront to gain the attention of anterior segment surgeons and so it was an excellent gesture to include the article on torsional phacoemulsification in the present issue. Torsional phaco though introduced since 2006 by the Alcon group is being used only in a few centers at present.

The article on quantification of energy distribution during torsional phacoemulsification using videography was an innovative and informative one, especially as quantifying the energy distribution for each step is a novel venture. Since the aim of the study was to assess the cumulative dissipated energy (CDE) for each step in phaco, I have a few queries as to how the same can be quantified exactly for each of these steps. The formula mentioned in the article for calculation of (CDE) is incomprehensible. On literature search CDE = (average U/S power×U/S time) + (Torsional amplitude×Torsional time×0.4) in the IP (intelligent phaco) mode and Torsional amplitude×Torsional time×0.4 in pure torsional mode[1].

The 3 major steps for which power used were for burr, chop and emulsification. As mentioned in the article the time for chop was more as it included rotation of the fragments and in the discussion the author has mentioned that this artificial increase in time decreases the rate of energy generation during chop. However, can the same be explained by the formula for CDE also since according to the display on screen it is mentioned as torsional time in foot pedal position 3 which is usually being used for short periods of time during chop.

Was there any combined use of longitudinal and torsional phaco in any of the procedures especially in hard cataract where occlusion can ensue, in which case longitudinal phaco plays a corrective role.

The author definitely has made clear the advantages of this technology; however, the statistical significance of the observations was not evident in the results.

To summarize, it was an excellent attempt by the author to stimulate the reader's instincts to pursue advancements in technologies which are occurring at such rapid pace in our specialty; so much so that to keep up with this, we need to keep all our senses alert, failing which we may be in a pathetic state to hear the same from one of our better read patients.

Dr Meena C.K.,
Sr. Consultant, Little Flower Ophthalmic Institute, Angamaly

1. Ding et al., J Clin Exp Ophthalmol 2013,

The Author's Reply

The authors wish to express appreciation of the detailed analysis of the article provided by the writer. We fully agree with the writer that a misprint in the article that we sent for publication has rendered the CDE formula incomprehensible. The formula used in the original article is the one provided by the manufacturer's Operator's Manual.

Regarding the query on the CDE from the display panel, surgeons familiar with the Infinity machine would agree that the display panel provides metrics in terms of average torsional amplitude in position 3, torsional time and cumulative energy values. It doesn't distinguish between the phaco steps or give a split up of the CDE. This necessitated us to use a videographic frame by frame analysis that has been documented earlier[1] to use the visuals to determine the beginning and end of each step. The "rate" of energy production during a step is a function of the time that the particular step has consumed during surgery , whatever be the footpedal position. Furthermore even for apparently continuous steps like burring and emulsification, there is always a time gap when energy is not being used, eg when the needle is lifted from the nucleus and reimpaled or is moved from one piece to another during emulsification. This discontinuity in the use of footpedal position 3 is enhanced during chopping. It is for this reason that the rate of CDE generation was chosen as a parameter for the study. The absolute values of CDE and time taken have been clearly stated for interested readers in table 1 and figure 5.

In the context of longitudinal energy use ,the authors would like to draw attention to the materials and methods section where it is expressly stated that Ozil energy was used with amplitudes 0 – 100%. The authors would also like to reiterate that the title itself states that the study quantifies energy during torsional phaco, hence only that modality was used, precluding any role for the combined modality.

The study quantifies the amount of energy dissipated in the system in absolute values for different grades of cataract and various steps of surgery for a single modality. Since there is no comparison across modalities, the use of the P value ,that is nevertheless automatically calculated by the software, becomes limited as it answers neither the question what the magnitudes of sample effects are nor whether the results will generalize. Besides the study stresses less on highlighting the torsional technology and more on how in such an advanced technology also, there is production of finite energy during the preemulsificationstages, that may be entirely avoided by using prechop methods like the femtosecond laser.

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Dr. Swapna Nair, Dr. K G R Nair
Chaithanaya Eye Hospital, Trivandrum

Dear Editor,

The case discussed in diagnostic challenge section – Refractive Surgery Problem is indeed a very difficult and challenging case.

As mentioned by the author, post LASIK central corneal haze can be due to the Central Toxic Keratopathy (CTK), Diffuse Lamellar Keratitis (DLK) or Pressure Induced Stromal Keratitis (PSIK). In retrospect it is much easier to analyse the course of events that happened and make a hypothesis on the probable etiology and management steps, rather than when faced with such a situation. From the course of events that occurred, it is probable that there had been an element of all three of the above mentioned etiology in this case.

It is well known that CTK in most cases is preceded by or associated with DLK. It is rare to have CTK in the first postoperative day. It usually starts in the 3rd or 4th postoperative day and preceded by DLK. So the usual diagnostic dilemma is to differentiate between CTK and stage 4 DLK. Edema rather than cells makes DLK less likely and favors CTK in this particular case. The edema in turn could have made difficult or impossible to appreciate the associated DLK (presence of cells). Though there is no role of steroids in CTK, the use of steroids controls the DLK which is most often associated with CTK and CTK is known to be a self limiting condition which resolves spontaneously in 2 to 18 months. The failure of the edema to improve with intensive topical steroids initially makes the diagnosis of CTK more likely.

The fallacy of IOP measurement in cases with central corneal edema especially if associated with PISK is well known. The improvement of edema on stopping the topical steroids points finger towards PISK. Probably as mentioned by the discussants an anterior segment OCT could have helped in this situation. The discontinuation of topical steroids in this situation though helped in the resolution of edema could have resulted in worsening of the associated DLK. In retrospect probably addition of oral steroids could have prevented the worsening of DLK.

The etiopathogenesis of the epithelial ingrowth and subsequent flap melt has been explained well by the discussants. Edema and retraction of the thin flap (as documentd by the AS OCT) might have resulted in epithelial ingrowth and subsequent flap melt. As mentioned by Dr.Sujith flap lift is not advisable in CTK as CTK is associated with stromal melt and can result is stromal loss and button holing of the flap. So patient waiting till CTK resolves is essential prior to lifting flap to manage the epithelial ingrowth. Unfortunately this case developed progressive flap melt. Once progressive melt starts, then flap relift and scrapping needs to be done as has been done in this case.

The course of events in this case might have been initial CTK with associated DLK which was masked by the edema. Topical steroids might have controlled the DLK initially but could have resulted in PISK, which could be the reason why the edema improved on stopping the steroids. But abrupt discontinuation of topical steroids resulted in worsening of DLK. At the same time poor adhesion of an edematous thin flap and retraction of the edges would have resulted in the epithelial ingrowth and subsequent melt of the flap edges.

This case is extremely difficult and challenging to manage. As I mentioned before, the only additional step I think could have been done in managing this case is probably adding oral steroids when the topical steroids was being planned to be discontinued. I have to congratulate Dr Sujith and his team in managing this case extremely well as has been documented by the excellent final visual outcome.

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Dr. Vinay S. Pillai
Consultant Cornea Surgeon,
Giridhar Eye Institute, Kochi

Authors reply

The comments from Dr Vinay Pillai very well summarises the various etiopathogenesis that happened in our case. I thank him for reading this article in detail and with deep interest and also for critically analyzing it as it was done by the experts who had taken part in the discussion. He very well said that our case is a combination of CTK, DLK and epithelial ingrowth that happened sequentially triggered by thin flap and management was complicated by steroid responder status of the patient. Dilemma was between lifting of flap (in DLK) vs not lifting (in CTK) and intensive steroids (in DLK) vs no steroids (in CTK) vs inability to tolerate steroid(responder). Oral steroids was of course a choice which was missed out in those indecisive days and its administration could have driven the case in another direction.

Dr. Sujith V. Nayanar
Vasan Eye Care
Calicut

Dear Dr Ashok
Let me congratulate you for coming out with an excellent edition of KJO.

In this issue the original article "Analysis of Bleb Morphology AfterTrabeculectomy with Anterior Segment Optical Coherence Tomography" attracted my attention. Even though it is a simple non-invasive method, it gives us a lot of information regarding the Anatomical structure of the bleb which reflects on the functioning of the bleb. The thickness of the wall of the bleb gives us the nature of filtering function. The micro-cyst, which cannot be seen with slitlamp, is clearly made out in AS-OCT. That also gives us information on the functioning of bleb. The ostium can be visualised by AS-OCT.

Even though there are a lot studies on this, the method adapted by the Dr Girija et al needs an appreciation. The meticulous analysis is the highlight.

The next step in this study is to find a method to determine the rate of flow of Aqueous through the ostium.

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Vavvakkavu Kollam
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General Instructions to Authors

The Kerala Journal of Ophthalmology (KJO) is a quarterly; peer reviewed one, devoted to dissemination of the latest in ophthalmology to the General Ophthalmologists as well as to specialists in the various subspecialties of this discipline. It invites submission of original work dealing with clinical and laboratory materials.

Authors submitting materials to this journal are requested to adhere STRICTLY to the norms laid down below. The matter must be typed on one side of the paper. A margin of 1" must be left all around and the material must be double spaced. A page should contain not more than 25 lines. Two copies of the text in paper and one copy in a CD must be submitted to the Editor and the corresponding author is advised to keep another copy with him. The corresponding author must give it in writing in his covering letter that the same matter will not be submitted elsewhere if accepted. He must also enclose the copyright transfer of his work to this journal. The papers sent will be subjected to peer review. The accepted manuscripts become the permanent property of this journal. The author is informed that, if his work is returned to him for correction / clarification after peer review, he should effect the same and send the manuscript back to the Editor within one month. Each manuscript component mentioned here under must begin with a new page and the pages are to be numbered at the right tip corner starting from the Title page.

1. TITLE: The title of the work must be brief and precise. It should not exceed two lines and 40 characters (including comma, period) Author(s) full name (s) must be given along with his (their) degree and the affiliations. Corresponding author's name, correct address (including e-mail and Fax, if available) and phone number must be mentioned at the bottom left hand corner of the first page.

2. ABSTRACT: The abstract is to be given in the beginning itself. It should not exceed 200 words. It must contain the aim, methodology, results and conclusion. For case report, summary / conclusion alone is to be given.
KEY WORDS: (maximum five) in capitals are to be included at the end of Abstract.

3. INTRODUCTION: Describe the aim of the study, along with the hypotheses that were tested. Only necessary references are to be given.

4. METHOD: Give in detail the materials used and the methods employed. Describe the type of study. Pharmacological names only must be mentioned for the drugs used and, if proprietary name is used, then the manufacturers name must be given in parentheses. Except for standard, well-accepted abbreviations (including SI Units), all others must be introduced in parentheses when the full term is used for the first time in the article.

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