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Abstract: Abstract of original article should be in structured format with the following sub-headings: Objective, Design, Place and duration of Study, Patients & Methods, Result and Conclusion.

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Methods: Study design and sampling methods should be mentioned. The selection of the observational or experimental subjects (patients or experimental animals, including controls) should be described clearly. The methods and the apparatus used should be identified and procedures described in sufficient details to allow other workers to reproduce the results and references to established methods. All drugs and chemicals used should be identified precisely, including generic names, doses, routes of administration.

Results: These should be presented in a logical sequence in the text, tables and illustrations. Only important observations should be emphasized or summarized.

Discussion: The author’s comments on the result, supported with contemporary references, including arguments and analysis of identical work done by others. Brief acknowledgement may be made at the end.

Conclusion: Conclusion should be provided under separate heading and highlighting new aspects arising from the study. It should be in accordance with the study.

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Corneal dystrophies are a group of genetic, often progressive, eye disorders in which abnormal material often accumulates in the clear transparent cornea. Corneal dystrophies may not cause symptoms (asymptomatic) in some individuals; in others they may cause significant vision impairment. The age of onset and specific symptoms vary among the different forms of corneal dystrophy. The disorders have some similar characteristics; most forms of corneal dystrophy affect both eyes, do not affect other areas of the body, and tend to run in families. Most forms are inherited as autosomal dominant traits; a few autosomal recessive traits, taking into account the chromosomal loci as well as the responsible genes and their mutations.

Fuchs’s Corneal Dystrophy (FCD) is characterized by dysfunction of the corneal endothelium, leading to reduced vision. The prevalence of FCD has been estimated at about 5% among persons over the age of 40-50 years affecting women 4 times more than the men and is the most common indication for corneal transplantation. The ability to diagnose FCD before symptoms develop and knowledge of the biologic pathways leading to the disorder are important.

Corneal transparency is critically dependent on a mono-layer of endothelial cells to maintain the dehydration and hence the clarity of its collagenous stroma, which makes up 90% of corneal thickness. The cornea shows extracellular deposits, usually called guttae which confer a “beaten-metal” appearance to the innermost endothelial layer. These excrescences (guttae) are the clinical hallmark of FCD and become more numerous with progression of the disease. As the endothelial layer develops confluent guttae in the central cornea, the cornea swells and becomes cloudy because the remaining endothelial cells are not sufficient to keep the cornea dehydrated and clear. There is reduced water movement out of the cornea, causing stromal hydration. This process impairs corneal transparency, giving rise to glare and blurred vision, most noticeably on waking in the morning. Cataract surgery in such patients can accelerate endothelial-cell loss, resulting in further edema of all corneal layers, loss of vision, and a blind, painful eye.

Most cases of corneal dystrophy are inherited as an autosomal dominant trait with variable expressivity. Genetic diseases are determined by the combination of genes for a particular trait present on the chromosomes received from the father and the mother. Dominant genetic disorders occur when only a single abnormal gene is necessary for the appearance of the disease. This abnormal gene can be inherited from either parent, or can be the result of a new mutation in the affected individual. The risk of passing the abnormal gene from affected parent to offspring is 50 % for each pregnancy regardless of the sex of the resulting child. Variable expressivity means that some individuals who inherit the same gene for a dominant disorder may not develop the same symptoms. The chance for a child to receive normal genes from both parents and be genetically normal for that particular trait is 25 %. The risk is the same for males and females.

Investigators have determined that several corneal dystrophies occur due to disruptions or changes (mutations) of the Transforming Growth Factor Beta-induced (TGFBI) gene located on the long arm (q) of chromosome 5 (5q31). Each chromosome has a short arm designated “p” and a long arm designated “q”. Chromosomes are further sub-divided into many bands that are numbered. For example, “chromosome 5q31” refers to band 31 on the long arm of chromosome 5. The numbered bands specify the location of the thousands of genes that are present on each chromosome.

FCD is thought to be a genetically complex trait that has been observed in 38% of the first-degree relatives of probands. Although rare genetic variation that contributes to both early onset of familial disease and late onset of age-related disease has been identified, no common variants have been reported. Early onset has been linked to mutations in the COL8A2 gene, encoding the α2sub-unit of collagen VIII, a component of the endothelial basement membrane.

Researchers identified two regions of the genome that appear to contribute to FCD. The first region spans
the \textit{TCF4} (Transcription Factor4) locus and was significantly associated with FCD at the genomewide level. The second region, spanning the Protein Tyrosine Phosphatase Receptor type G (\textit{PTPRG}) locus, was strongly associated with FCD, but the association did not reach genomewide significance. Genetic variation across the \textit{TCF4} locus may explain the linkage signal with FCD previously observed on chromosome 18q21. The high impact on disease risk suggests that a pathway regulated by E2-2, the protein encoded by \textit{TCF4}, is a major contributor to FCD. E2-2 is expressed in the developing corneal endothelium and is an attractive candidate for FCD.

\textit{PTPRG} belongs to the protein tyrosine phosphatase (PTP) family, members of which regulate a wide array of cellular functions, including growth, cell mobility, gene expression, cellular adhesion, ion channel control and oncogenesis. It has yet to be determined whether \textit{PTPRG} interacts with Zinc Finger E-Box binding homoeo box1 (\textit{ZEB1}) or E2-2.

The biologic pathways that are implicated by the contribution of \textit{TCF4} and probably \textit{ZEB1} gene, which encodes the zinc finger E-box binding homeo box 1 protein, and \textit{PTPRG} variants to typical FCD suggest several mechanisms of pathogenesis as seen in patients with FCD. Another mechanism could be increased cellular stress through abnormal development of the basement membrane, abnormal ion-channel regulation, or premature senescence.

In \textit{conclusion}, the findings suggest that genetic variation in the \textit{TCF4} locus substantively contributes to the risk of FCD. The genetic risk appears to localize to multiple regions of the \textit{TCF4} locus and the presence of these haplotypes confers a high risk of FCD.

As far as the treatment is concerned, several factors determine what therapy may be used, keeping in view of the severity of symptoms, the rate of progression and the patients’ overall health and quality of life. It is mostly symptomatic and supportive. Individuals who have mild symptoms may not require treatment and may instead be regularly observed to detect progression of the disease. Specific treatment may include eye drops, ointments, laser and corneal transplant. Recurrent corneal erosions, a common finding, may be treated with bandage contact lens. If recurrent erosions persist, additional measures such as corneal scrapings or use of Excimer laser therapy, which can remove abnormalities from the corneal surface (photo-therapeutic keratectomy), may be undertaken. In individual with advanced symptoms, Keratoplasty is highly successful. However, there is a risk that the lesion may eventually develop in the graft.

Though multiple factors have been accrued in the development of FCD, yet the subject is a challenge to researchers. In our country, cases are not very frequently seen in our daily practice and we do have a very

\begin{figure}[h]
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\includegraphics[width=\textwidth]{fuchsdystrophy.png}
\caption{Features of Fuchs’s Corneal Dystrophy (FCD)}
\end{figure}

In Panel A, a clinical photograph shows severe corneal edema caused by FCD, with an associated loss of corneal clarity. In Panel B, a confocal photomicrograph of the corneal endothelium in a control subject shows the normal appearance of the endothelial monolayer, with a regular mosaic of small, densely packed cells. In Panel C, a confocal photomicrograph of the corneal endothelium in a patient with FCD shows larger but fewer endothelial cells. The dark areas are sub-endothelial deposits called guttae. (Courtesy: NEJM - UK)
skeptic outlook pertaining to the course and prognosis of the disease. So far no attempt has ever been made to undertake the genetic study of FCD by our scientists of Molecular Biology except a scanty research which has been reported against Retinitis Pigmentosa. Moreover, there is hardly any data available regarding the incidence of FCD in our country.

Hence, it is important and the need of the hour to embark on research for hereditary/genetic disorders in Pakistan, where consanguineous marriages are more common in our society and hereditary disorders are often seen in our daily practice. No doubt, our scientists are well versed in the study of Genetics and Molecular Biology, there is a word of advice for them to undertake more research on the challenging topics rather wasting time on already researched or stereotyped projects, a trend commonly observed today. However, genetic counseling may be beneficial to the affected individual and his family.

REFERENCES


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Do we need to Redefine Laser Indications in Diabetic Maculopathy?*

Sanaullah Jan1, Yousaf Jamal Mahsood2, Muhammad Naeem Khan3
Samina Karim4, Zakir Hussain5

ABSTRACT:
Objective: To determine the inter ophthalmologists bias while diagnosing the diabetic maculopathy as Clinically Significant Macular Edema (CSME) in diabetic individuals.

Study Design: An observational case series.

Place and Duration: Department of Ophthalmology, Hayatabad Medical Complex, Peshawar, Pakistan from 1st Jan 2011 to 31st May 2011 (for the duration of seven months).

Methodology: This observational case series included all the diabetic patients of both gender after informed verbal consent. Diabetic individuals with any severity of diabetic maculopathy irrespective of stage of diabetic retinopathy were included. Eyes with co-morbidities like cataracts or corneal opacities and complications like vitreous bleed which renders fundus examination impossible or doubtful were excluded. Eyes with co-morbidities like Age Related Macular Degeneration (ARMD) and hypertensive retinopathy (as agreed by both consultants) were excluded as they may mimic Diabetic Macular Edema (DME). The data was collected using a predesigned proforma. All the patients were examined by two consultant ophthalmologists with at least eight years of postgraduate experience with 78D lens on slit lamp biomicroscopy. Both consultants were blinded regarding the clinical assessment and decision of one another. Consultants decision was recorded whether maculopathy is clinically significant or not clinical significant. Their confidence level regarding their decision was also assessed as >80%, 61-80% and 51-60%. The data was analyzed by means of SPSS software version 17.

Results: Total of 83 eyes of 45 patients were included in the study (both consultants excluded one eye of seven patients due to media opacities). However in one consultant commented only on 82 eyes excluding another eye because of media opacities. Consultant-II commented on 82 eyes only. Mean age of our patients was 53.64 years. Male were 25 (55.6%) and female were 20 (44.4%). Eight (17.8%) patients were of type I diabetes while 37 (82.2%) were having type II. Maculopathy was clinically significant in 38 (45.8%) eyes and in 45 (54.2%) eyes, the consultant-I classified maculopathy non-significant. While consultant II diagnosed CSME in 39 (47.6%) eyes out of 82 eyes. In 2.4% eyes, diagnosis of both consultants were different from each other (Age related maculopathy versus CSME respectively). Confidence levels of both consultants regarding their clinical decisions was also varied with 80% or more confidence level in 88% and 63% respectively.

Conclusion: The clinical diagnosis of CSME show statistically insignificant difference or error among ophthalmologists of almost same clinical experience. However the confidence with which CSME is diagnosed vary even among ophthalmologists of same experience.

Key words: Clinically Significant Macular Edema; CSME; Diabetic macular edema; Laser for CSME.

INTRODUCTION:
Diabetic retinopathy (DR) is a disorder of retinal vasculature that affects almost all individuals with long standing diabetes mellitus1. Blindness occurs 25 times more commonly in diabetic individuals compared to normal individuals2. The fastly growing global epidemic of diabetes mellitus and the resultant complications including diabetic retinopathy is the serious concern for the health care authorities. Diabetic maculopathy (DM) is the common cause of visual loss in diabetic individuals3,4. It is secondary to compromise vascular permeability and accumulation of hard exudates at macula which can occur at any stage of retinopathy1. In diabetic individuals of more than 20 years duration, Clinically Significant Macular Edema (CSME) is present in 29% of patients5. Diabetic maculopathy prevalence is reported to be 17.6% in diabetics as reported by one of the national study2. The Early Treatment Diabetic Retinopathy Study (ETDRS) was the first study to clinically grade the severity of macular edema5. This study established the benefits of laser therapy for macular edema and concluded that laser treated eyes had decreased risk of having moderate visual loss versus observation group and greatest benefits were shown in eyes with CSME5,6. ETDRS data provided the basis for global acceptance of laser therapy as the first
Do we need to Redefine Laser Indications in Diabetic Maculopathy?

The line of treatment for diabetes maculopathy which is still in practice. However, ETDRS defined diagnosis of CSME was subjective and based on clinical assessment by ophthalmologist by slitlamp biomicroscopy with 78D. No objective tools were used to grade the macular edema as a clinical significant in this study. As per available evidence, laser treatment is indicated only in eyes having CSME. There are studies which reported that the retinal thickness may not be detected by clinical observation only. Now, as the clinical expertise and experience may vary among different ophthalmologists, the subjective assessment of CSME may show errors. This condition of CSME may be under or over diagnosed. As a result, by following the ETDRS defined indications for laser in macular edema, we may be over or under treating our patients. There may be a number of eyes which will benefit from laser but may be missed while there may be eyes which does not require treatment but may be receiving treatment with no evidence based visual benefits. This treatment practice may be just because of over or under diagnosis of CSME by ophthalmologists in patients with diabetes mellitus. This mis-directed management may also have significant socioeconomic impact on our national resources and eye care services. This hypothesis that the diagnosis of CSME may be biased due to inter-ophthalmologists clinical assessment variation, urged us to design and conduct this study to determine the inter-ophthalmologists bias while diagnosing the diabetic maculopathy as CSME in diabetic individuals.

**METHODOLOGY**

This observational case series was conducted at the Department of Ophthalmology, Hayatabad Medical Complex, Peshawar, Pakistan from 1st Jan 2011 to 31st May 2011 (for the duration of seven months). All the diabetic patients of both gender were included into the study after informed verbal consent. Diabetic individuals with any severity of diabetic maculopathy irrespective of stage of diabetic retinopathy were included. Known diabetics of type I and type II diabetes mellitus or individuals with typical features of diabetic retinopathy and maculopathy who were then investigated to be diabetic (fasting plasma glucose ≥7 mmol/l or random plasma glucose ≥11.1mmol/l as recommended by WHO) were included in our study. Eyes with co-morbidities like cataracts or corneal opacities and complications like vitreous bleed which renders fundus examination impossible or doubtful (as per consultant decision) were excluded. Eyes with co-morbidities like Age Related Macular Degeneration (ARMD) and hypertensive retinopathy (as agreed by both consultants) were excluded as they may mimic DME. The data was collected using a predesigned proforma. All the patients were examined by two consultant ophthalmologists with at least eight years of postgraduate experience in the tertiary care teaching institute. Both consultants examined the eyes by 78D lens on slit lamp biomicroscopy. Both consultants were kept blinded regarding the clinical assessment and decision of one another. Consultants decision was recorded whether maculopathy is clinically significant or not clinically significant. Their confidence level regarding their decision was also assessed as >80%, 61-80% and 51-60%. The data was analyzed by means of SPSS software version 17.

**RESULTS**

Total of 83 eyes of 45 patients were included in the study. Both consultants excluded one eye of seven patients due to media opacities. However in one patient, one consultant commented while the other consultant didn’t comment because of media opacities. The comments of consultant II were recorded on 82 eyes only. Mean age of our patients was 53.64 years. Male were 25 (55.6%) and female were 20 (44.4%). There were 8 (17.8%) patients from type I diabetes while 37 (87.2%) were having type II. Maculopathy was classified as clinically significant in 38 (45.8%) eyes and non-significant in 45 (54.2%) eyes by the consultant I. While consultant II diagnosed CSME in 39 (47.6%) eyes and nonsignificant maculopathy in 43 (52.4%) out of 82 eyes. Clinical diagnosis of CSME in our patients is shown in Table I. The difference between accuracy of clinical decision to diagnose CSME between consultants was not statistically significant (P-value of 0.44 and 0.51 respectively) in our study. Confidence levels of both consultants regarding their clinical decisions is shown in Table II. It was interesting to note that 2 (2.4%) eyes of one patient which were diagnosed as having CSME by consultant II were regarded to be having drusen by consultant I. Similarly one eye classified as having CSME by consultant I, was labelled by consultant II as having ARMD.

**DISCUSSION**

Although the pathogenesis of macular edema in diabetic individuals is complex and it results secondary to compromised blood retinal barrier and collection of intra retinal fluid, proteins and other blood constituents at the macula. Diabetic Macular Edema (DME) is graded as clinically significant or non-significant macular edema for the purpose of laser treatment as a part of standard care and protocol based on recommendation of ETDRS. CSME if present in eyes and CSME which involves the foveal center has the risk of moderate visual loss in 24% and 33% eyes respectively within 3 years if not treated by laser application. As per evidence till date, the laser therapy is only indicated when the diabetic macular edema is classified as CSME. However the grading of DME as
In the ophthalmic community, the clinical expertise, respectively, in our study. It is also worthy to note that in 2.4% eyes consultants had diagnosed totally different pathologies i.e., (CSME versus ARMD). This difference of opinion in diagnosis of CSME raises serious concern regarding subjective definition of CSME based solely on the clinical expertise of different ophthalmologists. Besides clinical expertise, the clinical experience, quality of stereopsis and visual status also vary among practicing ophthalmologists thus affecting their assessment and final decision to classify the DME as clinically significant. Ultimately such subjective errors in diagnosis will affect the decision of laser application in our patients with diabetic maculopathy and the significance of under or over treatment of eyes with diabetic maculopathy can not be overestimated. Although the search for better treatment options continues but standard care of diabetic macular edema is laser application, which is still in practice globally. We hope that our study will be considered as part of “icebreaking” and basis for planning multi-centered, large sample-sized studies which will be able to better answer the question of challenging the subjective diagnosis of clinically significant macular edema.

At present, there are plenty of recent available tools such as Optical Coherence Tomography (OCT), retinal thickness analyzers etc which can better classify the macular edema quantitatively and more objectively7,14. At the same time, OCT is a non-invasive tool and is well tolerated by patients. Such objective tools like OCT can benefit the patients in terms of diagnosis in the early stages of DME which yet may not be obvious clinically and at the same time will be helpful by exactly measuring the macular edema while practicing various treatment options to decrease macular edema and to improve visual function in the affected eyes or vice versa. Although such objective classification also need to be tested by multi-center randomized controlled trials of standard, similar to that of ETDRS for the purpose of evolving better treatment strategies.

The living search to find better treatment options for DME to have better visual outcomes, surely continues. This search has resulted in evolving and emerging options of intravitreal anti-VEGF, intravitreal

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<th>Table I Clinical diagnosis of CSME</th>
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<tr>
<td>CSME</td>
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<tr>
<td>YES</td>
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<td>NO</td>
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CSME: Clinically Significant Macular Edema, n: number, %: percentage

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<th>Table II, Confidence levels of consultants regarding clinical decision in diagnosing CSME</th>
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<td>Confidence level</td>
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<td>&gt;80%</td>
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<tr>
<td>61-80%</td>
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<td>51-60%</td>
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CSME: Clinically Significant Macular Edema, n: Number, %: Percentage, >: More than

Clinically significant is based on clinical assessment and decision of ophthalmologist after examining the patient fundus on slitlamp biomicroscopy with 78 Diopter lens13. Although Fundus Fluorescein Angiography (FFA) can show different patterns by classifying the CSME as having focal and diffuse patterns thus augmenting the execution of laser application but is not essential for diagnosing of CSME. At the same time, the leakage on FFA is not diagnostic for retinal edema as the retinal edema or thickness is the end result of compromised balance between fluid leakage into the retina and fluid clearance out of retina by retinal pigment epithelium pump mechanism13. As the diagnosis of CSME is based on clinical assessment by ophthalmologists, are the indications for laser application in DME. The subjective basis for definition of CSME may show errors in diagnosis and may result in mis-management of diabetic eyes with diabetic maculopathy. Our study was designed to determine whether the statement that “there may be subjective variations in diagnosing DME as CSME” is valid or not. We purposely included assessment of our patients’ eye by two consultants of almost similar clinical experience and even then we had encountered difference of opinion regarding status of CSME in eye with signs of diabetic maculopathy. Although the difference between accuracy of clinical decision to diagnose CSME between ophthalmologists of almost same experience was not statistically significant (P-value of 0.44 and 0.51 respectively) in our study. It is also worthy to mention that in ophthalmic community, the clinical expertise, experience and level of stereopsis of clinicians widely varies. Thus we presume that difference of opinion regarding diagnosing of CSME may also widely vary if ophthalmologists of different level of experience and expertise are included in future studies. At the same time, it is also obvious from the our data, that confidence levels of both consultants widely varied and was different regarding their own assessment and decision to classify the maculopathy as “clinically significant” or “clinically not significant”. It is also worthy to mention that in ophthalmologists of almost same experience was not worthy to note that in 2.4% eyes consultants had diagnosed totally different pathologies i.e., (CSME versus ARMD). This difference of opinion in diagnosis of CSME raises serious concern regarding subjective definition of CSME based solely on the clinical expertise of different ophthalmologists. Besides clinical expertise, the clinical experience, quality of stereopsis and visual status also vary among practicing ophthalmologists thus affecting their assessment and final decision to classify the DME as clinically significant. Ultimately such subjective errors in diagnosis will affect the decision of laser application in our patients with diabetic maculopathy and the significance of under or over treatment of eyes with diabetic maculopathy can not be overestimated. Although the search for better treatment options continues but standard care of diabetic macular edema is laser application, which is still in practice globally. We hope that our study will be considered as part of “icebreaking” and basis for planning multi-centered, large sample-sized studies which will be able to better answer the question of challenging the subjective diagnosis of clinically significant macular edema.

At present, there are plenty of recent available tools such as Optical Coherence Tomography (OCT), retinal thickness analyzers etc which can better classify the macular edema quantitatively and more objectively7,14. At the same time, OCT is a non-invasive tool and is well tolerated by patients. Such objective tools like OCT can benefit the patients in terms of diagnosis in the early stages of DME which yet may not be obvious clinically and at the same time will be helpful by exactly measuring the macular edema while practicing various treatment options to decrease macular edema and to improve visual function in the affected eyes or vice versa. Although such objective classification also need to be tested by multi-center randomized controlled trials of standard, similar to that of ETDRS for the purpose of evolving better treatment strategies.
steroids (including sustained release implants), other recent therapeutic options, recent laser therapy with more accuracy and less collateral damage to retinal pigment epithelium and sensory retinal tissue, and various combinations of different treatment options. The indications to treat DME need to be based on objective assessment and various treatment options need to be tested in terms of efficacy to decrease macular edema, improve visual functions and their safety. Therefore in this evolving era of modern technology and recently introduced promising treatment options, ophthalmic care community need to determine more objective indications to treat DME with best options after evolving evidence based globally accepted standard protocols. Such management will surely result in provision of better eye care to diabetic individuals by avoiding the errors due to subjective assessment of CSME by clinical ophthalmologists.

CONCLUSION:

The clinical diagnosis of CSME show statistically insignificant difference or error among ophthalmologists of almost same clinical experience. However the confidence with which decision is made to diagnose CSME varies even among ophthalmologist of same experience.

REFERENCES:


Ocular Trauma Associated with Bomb Blast
Junaid Faisal Wazir¹, Inayatullah Khan², Imran Ahmad³, Sabir Mohammad⁴, Zaman Shah⁵

ABSTRACT
Objective: To study the type and severity of ocular trauma associated with bomb blast.
Methods: It was a descriptive case series. The study was conducted at the Department of Ophthalmology, Khyber Teaching Hospital, Peshawar from December, 2009 to February, 2011. Detailed history was taken and complete ocular examination was done. B-scan was done to know about any posterior segment pathology (when required). Digital X-ray orbit and/or computed tomography were done to rule out intraocular foreign body. The treatment and follow up varied according to the type and extent of eye injury.
Results: Total number of patients were 79. Out of them 78 (98.73%) males and 1 (1.26%) female. Mean age of patients was 23.43 ± 10.67 years. Ocular injury was unilateral in 50 (63.29%) and bilateral in 29 (36.70%) patients. Forty-one (37.96%) eyes had closed globe injury and 67 (62.03%) had open globe injury. The most common type of injury was corneal/scleral perforation (48.14%) followed by vitreous haemorrhage (38.88%) and traumatic cataract (30.55%). The most commonly performed surgery was corneal/scleral repair (in 33 eyes). Final best corrected visual acuity (BCVA) improved in 56 (51.85%) eyes, remained unchanged in 49 (45.37%) eyes and worsened in 03 (2.77%) eyes.
Conclusion: Bomb blast related ocular trauma are becoming increasingly common. In severely injured eyes the visual prognosis remains poor despite development of advanced microsurgical techniques and better methods of visual rehabilitation.
Keywords: Digital X-ray, Computed Tomography (CT), Ocular trauma.

INTRODUCTION
Ocular trauma is an important and potentially preventable cause of ocular morbidity.¹ Ocular trauma form approximately 5-10% of all ophthalmic hospital admissions in non-industrialized areas and 39-42% in the industrialized community.² Every year more than half a million potentially blinding ocular trauma occur globally. There are approximately 1.6 million people who go blind from eye injuries, 2.3 million with bilateral visual impairment and 19 million with unilateral visual loss world-wide; thus ocular trauma is the commonest cause of unilateral blindness.³ In the United States approximately 2.5 million new eye injuries occur annually and around 40% of monocular blindness is due to eye trauma.⁴ Eye injuries can be broadly divided into 2 groups i.e. closed globe and open globe. Closed globe injuries are divided into contusion and lamellar laceration. Open globe injuries are divided into rupture and laceration.⁵ Etiological ocular trauma can be classified into domestic, occupational, sports, road traffic accidents, iatrogenic, fights and assaults and war injuries.⁶ Almost 100 years ago more than 70% of all serious ocular trauma occurred at the workplace.⁷ In the 1960s and 1970s, road traffic accidents became the most common cause of serious ocular injury.⁸ In the 1980s, sport and leisure activities became common causes of serious eye injuries.⁹,¹⁰ The home is now the most common location for eye injuries.¹² However, bomb blast and battlefield ocular trauma are becoming increasingly common in different parts of the world.¹³-¹⁵ In blast victims ocular injury may result from primary blast exposure. The blast effect shock wave propagates through the different medium of eyeball causing contusion and concussion injuries. Primary blast injury comprises non-penetrating mechanical injuries such as hyphema, globe rupture, subconjunctival haemorrhage, commotio retina and orbital fracture.¹⁶,¹⁷ However, ocular trauma is most commonly the result of secondary blast effects, in which debris displaced by the blast causes physical trauma to the eye and/or orbit. Secondary blast injury comprises penetrating or blunt-force injury to any part of the eye or orbit; open globe injuries, lacerations of the lacrimal system and eyelids comprise the majority of injuries in this group.¹⁸,¹⁹ The spectrum of eye injuries in blast victims ranges from very mild, innocuous to extremely serious with potentially blinding consequences. The purpose of our study was to study the type and severity of ocular trauma in blast victims, so that a comprehensive plan...
could be made for proper management of these patients.

PATIENTS AND METHODS:

This prospective study was conducted at Ophthalmology Department of Khyber Teaching Hospital, Peshawar, from December 2009 to February 2011. The study was done in collaboration with an organization which was working for people suffering from war injuries. All the patients were victims of bomb blast or mine blast, belonging to Afghanistan, Federally Administered Tribal Areas (FATA) and Swat. The patients were completely assessed by a team of physicians and surgeons and any serious systemic injuries were properly managed. Patients were then referred to us for the management of ocular trauma.

It was a descriptive case series study. Patients of all age groups and both genders, having blast-related injury to the eyeball were included in the study. Patients who had only ocular adnexal injury and those who did not come for follow up were excluded. Consecutive sampling technique was employed i.e. all the patients who met the inclusion criteria were studied. The study was approved by the ethical review board of the institution. Informed (verbal) consent was taken from all the patients and written informed consent was taken from those who needed surgery.

All patients were evaluated for types of ocular injury and extent of damage. Detailed history was taken and complete ocular examination was done including assessment of best corrected visual acuity (BCVA) with a Snellen’s chart, assessment of pupillary reaction with torch and slit lamp examination (Takagi SM-70, Japan). Intraocular pressure (IOP) was checked with Perkin's tonometer MK2 (Clement Clarke, London), when feasible. Fundus examination was done with 90 diopter lens (Volk, USA) and/or indirect ophthalmoscope (Neitz, Japan). In those patients with poor or no view of fundus, B-scan ultrasonography was done with AB 5500+ A/B Scan (Sonomed, USA). In those with open globe injury, B-scan was performed after restoring the globe integrity. Digital X-ray orbit was done in all patients. In those with high suspicion of intraocular foreign body (IOFB), a CT orbit (2mm section) was undertaken.

Primary repair was done under general anaesthesia (GA), in emergency, in those with corneal or scleral perforation. Evisceration was performed in patients with shattered globe (where repair was not possible) or if there was globe perforation with endophthalmitis. Subsequent management and follow up varied according to the type and extent of eye injury. Complete ocular examination was conducted at each follow up. SPSS-10 was used for data analysis.

RESULTS

Total number of patients was 79, including 78 males (98.73%) and 1 female (1.26%). Age ranged from 5 to 60 years with a mean of 23.43 ± 10.67 years. Age of the patients was < 10 years in 6 (7.59%) patients, 11-20 years in 28 (35.44%), 21-30 years in 31 (39.24%), 31-40 years in 10 (12.65%), 41-50 years in 2 (2.53%) and 51-60 years in 2 (2.53%) patients. The interval between the time of injury and presentation to ophthalmologist ranged from 1 to 10 days in 44 patients (60 eyes) and was more than 10 days in 35 patients (48 eyes). Ocular injury was unilateral in 50 (62.96%) patients and bilateral in 29 (36.70%) eyes. Forty-one (37.96%) eyes had closed globe injury and 67 (62.03%) had open globe injury. Of these 67 eyes, 25 (37.31%) had zone I injury, 6 (8.95%) had zone II injury and 36 (53.73%) had zone III injury. The most common type of injury was corneal/scleral perforation (48.14%) followed by vitreous haemorrhage (38.88%) and traumatic cataract (30.55%). The types of eye injury noted in our patients is given in Table-1.

In our study the initial visual acuity was no perception of light (NPL) in 25 (31.48%) eyes, perception of light (PL+) in 27 (33.78%) eyes, perception of light (PL+) in 27 (33.78%), hand movement (HM) in 20 (25.32%), hand movement (HM) in 20 (25.32%), counting fingers (CF) in 14 (17.74%), 6/60 to 6/18 in 8 (10.33%), 6/60 to 6/18 in 8 (10.33%), 6/60 to 6/18 in 8 (10.33%), 6/60 to 6/18 in 8 (10.33%), 6/60 to 6/18 in 8 (10.33%), 6/60 to 6/18 in 8 (10.33%) and 6/12 to 6/6 in 14 (12.65%) eyes. While the final VA was NPL in 27 (33.78%) eyes, PL+ in 13 (12.30%) eyes, PL+ in 13 (12.30%) eyes, HM in 8 (10.33%), CF in 13 (12.30%) and 6/60 to 6/18 in 13 (12.30%) and 6/12 to 6/6 in 34 (31.48%) eyes. In 61 (56.84%) eyes the final BCVA was < 6/60. Final BCVA improved in 52 (48.14%) eyes, remained unchanged in 52 (48.14%) and worsened in 4
Table 1:  
Type and number of eye injury

<table>
<thead>
<tr>
<th>Type of Injury</th>
<th>No. of eyes (%)</th>
<th>Type of Injury</th>
<th>No. of eyes (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corneal/Sceral perforation*</td>
<td>52 (48.14%)</td>
<td>Vitreous hamorrhage</td>
<td>42 (38.88%)</td>
</tr>
<tr>
<td>Cataract</td>
<td>33 (30.55%)</td>
<td>IOFB+</td>
<td>22 (20.37%)</td>
</tr>
<tr>
<td>Subconjunctival hemorrhage</td>
<td>22 (20.37%)</td>
<td>Corneal foreign bodies</td>
<td>19 (17.59%)</td>
</tr>
<tr>
<td>Corneal oedema</td>
<td>18 (16.66%)</td>
<td>Retinal detachment</td>
<td>16 (14.81)</td>
</tr>
<tr>
<td>Increased IOP++</td>
<td>15 (13.88%)</td>
<td>Sealed perforation #</td>
<td>15 (13.88%)</td>
</tr>
<tr>
<td>Hyphema</td>
<td>13 (12.03%)</td>
<td>Retinal hemorrhage</td>
<td>08 (7.40)</td>
</tr>
<tr>
<td>Endophthalmitis</td>
<td>08 (7.40%)</td>
<td>Macular scarring</td>
<td>06 (5.55%)</td>
</tr>
<tr>
<td>Corneal epithelial defect</td>
<td>01 (0.92%)</td>
<td>Corneal lameller laceration</td>
<td>01 (0.92%)</td>
</tr>
<tr>
<td>Iridodialysis</td>
<td>01 (0.92%)</td>
<td>Optic atrophy</td>
<td>01 (0.92%)</td>
</tr>
</tbody>
</table>

* – Including corneal perforation in 22 eyes, sceral perforation 07 eyes and carneo-scleral perforation in 23 eyes.
++ – Increased IOP was due to topical steroids in 8 eyes, due to free lens matter in 2 eyes, due to peripheral anterior synechiae in 2 eyes, silicone oil in 2 eyes and due to single recession in 1 eye.
# – It was corneal in 03 eyes, limbal in 01 eye and scleral in 11 eyes.

Table 2:  
Type and number of surgeries*

<table>
<thead>
<tr>
<th>Type of Surgery</th>
<th>No. of Surgeries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corneal/Sceral repair +</td>
<td>33</td>
</tr>
<tr>
<td>Evisceration</td>
<td>19</td>
</tr>
<tr>
<td>Vitrectomy ++</td>
<td>14</td>
</tr>
<tr>
<td>Cataract Extraction</td>
<td>12</td>
</tr>
<tr>
<td>Vitrectomy + Cataract extractig #</td>
<td>10</td>
</tr>
<tr>
<td>Others</td>
<td></td>
</tr>
<tr>
<td>Removal of silicon oil</td>
<td>3</td>
</tr>
<tr>
<td>Trabeculectomy</td>
<td>1</td>
</tr>
<tr>
<td>Opening of peripheral iridectomy</td>
<td>1</td>
</tr>
<tr>
<td>Pupiloplasty</td>
<td>1</td>
</tr>
<tr>
<td>Corneal autograft</td>
<td>1</td>
</tr>
<tr>
<td>Corneal autograft + Cataract extraction</td>
<td>1</td>
</tr>
<tr>
<td>Amniotic membrane graft</td>
<td>1</td>
</tr>
<tr>
<td>Removal of FB from limbus</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>98</td>
</tr>
</tbody>
</table>

* – In 46 eyes 1 surgery was performed in 14 eyes 2 surgeries were performed, in 06 eyes 3 surgeries were performed and in 01 eye 4 surgeries were performed.
+ – Including corneal repair in 21 eyes, scleral repair in 7 eyes and corneo-scleral repair in 5 eyes, IOFB removal was done in 1 eye.
++ – With IOFB removal in 5 eyes.
# – With IOFB removal in 6 eyes.

53.33% had BCVA of 6/12-6/6, 18.33% had BCVA of 6/60-6/18 and 28.33% had BCVA < 6/60.

**DISCUSSION**

Trauma is a common cause of ocular morbidity. The effect of trauma may be apparent immediately or may develop later as a secondary complication. Ocular trauma can cause permanent visual or cosmetic defect in the affected individuals and is a major cause of monocular blindness and visual impairment throughout the world.20

Ocular trauma victims are predominantly young males,21 as was the case in our study, with 78 (98.73%) males and 1 (1.26%) female. The causes of ocular trauma varies at different times and at different places.22 Bomb blast and mine blast are becoming increasingly common causes of ocular as well as systemic injuries. In the study.
Ocular Trauma Associated with Bomb Blast

conducted by Sethi MJ et al, bomb blast injuries accounted for 3% of ocular trauma.\(^8\) In another study blasts were responsible for 9% cases of ocular trauma.\(^22\)

The majority of blast-related ocular trauma occur in individuals who present with other life-threatening injuries that require immediate intervention. Surgical stabilization of any life-threatening injuries, as well as haemodynamic stability is required prior to initial evaluation by the ophthalmologist. Therefore, initiation of emergent ophthalmic care often occurs hours after injury.\(^18\) In our study, before being referred to us the patients were assessed by a team of physicians and surgeons and any serious systemic injuries were properly managed. Therefore, in most patients the initial eye evaluation was delayed for a few days. Visual outcomes for patients with ocular trauma due to blast injuries vary, and prognosis depends upon the type of injury sustained. The majority of poor visual outcomes arise from perforating injuries: only 21% of patients with perforating injuries with initial visual acuity of light perception had a final BCVA better than 6/60. Patients who have choroidal haemorrhage, perforating or penetrating globe injury, retinal detachment, traumatic optic neuropathy, and subretinal macular haemorrhage are more likely to have BCVA worse than 6/60. Reports from Operation Iraqi Freedom indicate that 42% of soldiers with globe injuries had a BCVA equal to or better than 6/12 six months after injury.\(^16,18,23\) During Afghan-Russia war the bomb blast injuries in Afghan refugees led to blindness in 27.2% cases.\(^24\)

The final visual outcome also depends on the type of eye injury.\(^18\) In our study, open globe injuries had poor visual outcome; 73.13% of these eyes had final BCVA < 6/60. On the other hand, only 29.26% of closed globe injuries had final BCVA < 6/60 while 58.65% had BCVA > 6/18. Initial visual acuity of NPL or PL+, the presence of relative afferent pupillary defect (RAPD), central corneal opacity, retinal detachment, endophthalmitis, macular scarring and optic atrophy were other factors associated with poor final visual outcome.

CONCLUSION

The visual prognosis in ocular trauma is variable. Bomb blast associated ocular trauma are becoming increasingly common. Bomb blast victims usually have very severe eye injuries. In such cases the visual prognosis still remains very poor despite development of advanced microsurgical techniques and better methods of visual rehabilitation.

REFERENCES

Photorefractive Keratectomy and Patient Satisfaction Level

M. Abdul Moqeet*

ABSTRACT:
Objective: To subjectively assess the overall patient satisfaction and self-perceived response to quality of vision following bilateral photorefractive keratectomy (PRK) with the help of a questionnaire.

Study Design: Qualitative survey.

Participants and Methods: The study was conducted at the department of Cornea and Refractive Surgery of Al-Shifa Trust Eye Hospital Rawalpindi on 34 out of 59 consecutive patients who underwent bilateral PRK for myopia ranging from -1.5 to -20 diopters with a minimum of six months follow up since the last surgery. A specially designed questionnaire was filled by all patients and the response of 34 patients (68 eyes) who were randomly picked up for analysis was evaluated. Their baseline myopia ranged from -1.50 to -20.00 diopters (DS) with a refractive cylinder ranging between -1.5 to -6.00 D.Cyl. They were all treated with Omni Med U.V 270300 excimer laser with an ablation zone one (5.00 mm) zone two (6.00 mm) and zone three (6.50 mm) diameter.

Results: Ten patients (29.41%) required glasses at times for distance vision however nobody used glasses permanently during six months duration. Twenty four (70.59%) subjects were enjoying life without wearing spectacles. Twenty three (67.65%) participants had clear vision, whereas, 11 (32.35%) subjects had some complaints as to quality of their vision due to foggy vision. Twenty six (76.47%) subjects were happy with the overall result at completion of six months, whereas, 8 (23.53%) subjects were not much comfortable with the overall outcome.

Conclusion: The level of satisfaction six months after PRK was generally high and quite encouraging in this survey. Subjective visual symptoms such as night vision problems and halo phenomenon did not have significant influence on overall patient satisfaction.

INTRODUCTON:
Myopia may be corrected satisfactorily with glasses and contact lenses but many people desire clear vision without dependence on any corrective optical devices 1. Strong desire of myopes to get rid of traditional optical corrections by glasses and contact lenses led to introduction of a variety of surgical procedures to correct myopia. PRK was invented in the early 1980s. FDA approved laser PRK for the first time in 1995. It modifies the anterior corneal curvature by laser ablation of superficial corneal tissue to correct myopia2. Due to relatively high patient satisfaction with the results, PRK rapidly gained popularity throughout the world as an effective alternative to glasses and contact lenses. PRK has arrived as a boon to the myopic population who previously has had to depend on other means of visual correction3. This article evaluated the overall patient satisfaction with this modality of treatment six months after the surgery.

PATIENTS AND METHODS
The study was conducted at the department of Cornea and Refractive Surgery of Al-Shifa Trust Eye Hospital Rawalpindi on 34 out of 59 consecutive patients who underwent bilateral PRK for myopia. Inclusion Criteria:
• Patients considered fit for refractive surgery after initial assessment.
• Age: 18-35 years old
• Mentally and physically in a stable health condition
• Able to read and understand the language of questionnaire
• Willing to participate in the study and communicated well with investigator
• Agreed to follow-up at scheduled times
Exclusion Criteria:
• Unable to read simple questionnaire and communicate conveniently
• Any corneal pathology which could interfere the visual outcome after surgery.
• Any other condition that would prevent completion of the questionnaire

The study was a prospective evaluation of patients’ satisfaction with PRK. Approval from the hospital ethical committee was taken for conducting the study. All the participants had healthy corneas before
surgery and no one had any systemic or ocular disease. All the patients were above 18 years and refractive error below -6.00 Diopters having stable myopia at least during the last one year. The refractive status of the subjects was as follows:

1. Myopia ranging from -1.50 to -6.00 D.S (Diopter Sphere) without astigmatism or with astigmatism up to -1.50 D.C (Diopter Cylinder)

2. Myopia from -6.25 to -20.00 D.S, without astigmatism or with astigmatism up to -4.00 D.C, Candidates were counseled before surgery that the procedure was intended to correct distance vision and they may require correction for the best distance visual acuity and eventually presbyopic glasses. All the multi zone procedures were performed, by one surgeon over a period of four months, entering spherical equivalent refraction by Omni Med U.V 270300 (Summit Technology Inc; Waltham MA) excimer laser, with affluence of 180 mj/cm² at a frequency of 10 Hz. Postoperative medications included tobramycin 0.3% and dexamethasone sodium phosphate solutions four times a day for a period of two weeks followed by fluromethalone 0.1% four times a day up to three months. An eye pad was placed on operated eye for at least 48 hours or till the completion of re-epithelialization of ablated area on the third postoperative day. A thorough examination was done at completion of six months after PRK, specific points were noted, glasses were prescribed if required or desired by the patients and a questionnaire was filled out by the patients at random. Answers were recorded without any prompting, to see overall satisfaction of the patient with the procedure.

The patients were asked the following six questions:

1. Do you experience night vision problems?
   a) Permanently
   b) Sometimes
   c) None

2. Do you experience halo phenomenon around light source?
   a) Permanently
   b) Sometimes
   c) None

3. How the night vision problem and halo phenomenon changed with time over the past six months?
   a) Improved
   b) Unchanged
   c) Worsened

4. Are you using glasses for distance vision?
   a) Permanently
   b) Sometimes
   c) None

5. Do you have foggy vision?
   a) Yes
   b) No

6. Are you happy with the overall result?
   a) Yes
   b) No

The results were analyzed using statistical software SPSS version 13.

RESULTS:

All the participants, both male 18 (52.95%) female 16 (47.05%), had good socioeconomic background and education and almost the same intelligence level. All were between 18 and 35 years of age group with a mean of 24.34 (±4.35) years, representing full range of myopia treated.

Following results were found after the analysis of questionnaires of 34 patients (Table 1,2,3,4,5). Ten patients (29.41%) required glasses at times for distance vision however nobody used glasses permanently during six months duration. Twenty four (70.59%) subjects were enjoying life without wearing spectacles. Twenty three (67.65%) participants had clear vision, whereas, 11 (32.35%) subjects had some complaints as to quality of their vision due to foggy vision. Twenty six (76.47%) subjects were happy with the overall result at completion of six months, whereas, 8 (23.53%) subjects were not much comfortable with the overall outcome. In short, none of these participants was really unhappy or annoyed but the level of satisfaction varied greatly as the expectation of some persons might be quite extraordinary.

DISCUSSION

Many factors contribute to patient satisfaction including accessibility and convenience of services, institutional structure and interpersonal relationships, competence of health professionals and patient’s own expectations and preferences. It has been proposed that multiple outcomes should be assessed, and that patient satisfaction with surgery is an important outcome measure to include in the assessment of surgical outcomes. Subjective patient satisfaction is the most important in the basic objective data points by which refractive surgery procedures can be judged. As such the number of studies is relatively small and research has tended to focus on objective clinical outcomes such as visual acuity and refractive errors, or symptoms such as the degree of halo, or glare. Previous results from studies carried out by telephone and questionnaire have indicated a high level of patient satisfaction from 84.6% to 92%. The satisfaction is not a one-dimensional concept that is, patient may be satisfied, with overall result, but may be, not be satisfied with the sub-component of the eventual outcome, such as, the
Table 1:
Night vision problems after PRK
Total= 34 patients

<table>
<thead>
<tr>
<th>Duration</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent</td>
<td>03</td>
<td>08.82</td>
</tr>
<tr>
<td>Sometimes</td>
<td>08</td>
<td>23.52</td>
</tr>
<tr>
<td>Never</td>
<td>23</td>
<td>67.66</td>
</tr>
</tbody>
</table>

Table 2:
Halo problems reported after PRK

<table>
<thead>
<tr>
<th>Duration</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent</td>
<td>05</td>
<td>14.71</td>
</tr>
<tr>
<td>Sometimes</td>
<td>08</td>
<td>23.52</td>
</tr>
<tr>
<td>Never</td>
<td>21</td>
<td>61.78</td>
</tr>
</tbody>
</table>

Table 3:
Progress in halo and night vision problems at 6months after PRK

<table>
<thead>
<tr>
<th>Status</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved</td>
<td>11</td>
<td>32.35</td>
</tr>
<tr>
<td>Unchanged</td>
<td>18</td>
<td>52.95</td>
</tr>
<tr>
<td>Worsened</td>
<td>05</td>
<td>14.70</td>
</tr>
</tbody>
</table>

Table 4:
Need for spectacle correction 6months after PRK

<table>
<thead>
<tr>
<th>Duration</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sometimes</td>
<td>10</td>
<td>29.41</td>
</tr>
<tr>
<td>Never</td>
<td>24</td>
<td>70.59</td>
</tr>
</tbody>
</table>

Table 5:
Foggy vision problem reported after PRK

<table>
<thead>
<tr>
<th>Duration</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>11</td>
<td>32.35</td>
</tr>
<tr>
<td>No</td>
<td>23</td>
<td>67.66</td>
</tr>
</tbody>
</table>

necessity to wear spectacles occasionally. Keeping all these considerations in mind, a questionnaire was constructed including questions related to night vision, halo problems, foggy vision and need to wear glasses after PRK. But the lack of questionnaire standardization makes it difficult to compare different studies and results. Furthermore level of satisfaction varies from individual to individual and it could be different in different situations and economic set up. Educational background and intelligence can affect the level of satisfaction of a patient with the procedure.

This study can be compared well with the one conducted by Nystrom and others in 1995, 36 patients after PRK, using 3.50 to 5.00 mm diameter ablation zone. They found 70% of the patients were happy with the overall results and 30% of patients had some complaints as to the quality of vision. We had 76.47% happy with the overall result and 23.53% were not very much comfortable with overall result. They also reported that 34% of patients always, 26% sometimes and 40% never experienced halo problems. Night vision and halo problems improved in approximately 50% of cases with time. Respective percentage of this study is 14.70%, 23.52%, and 61.78%. Nystrom et al, further reported that permanent night vision problems were experienced by 40%, 30% reported them sometimes and 30% reported no problem at all. Respective percentage of the current study is 8.82%, 23.52%, and 67.66%. Situation of night vision and halo problem also improved significantly with time. The difference in the results is due to difference in ablation diameters used to treat myopia. With the small optical zones (4.3 to 4.5 mm) of PRK, one would expect problems with glare and worsening of vision at night. Similarly halo phenomenon (halos around light sources) is common in patients treated with 3.5 mm zones, which is also evident in the comparison. Problems with glare, night halos, and blurred vision have been found in other studies but these tend to diminish with time. Nystrom et al further reported that 60% never needed to use glasses after treatment, 30% sometimes did, and 10% always wore distance glasses 3 years after surgery. In the current study 70.59% never needed glasses after PRK, whereas 29.41% required sometimes. The difference of 10% may be due to the difference of duration after which the study was conducted. Majority of the patients who have achieved good refractive and visual results at six months appear to remain stable, but the regression of effect, especially in higher refractive errors and need of glasses to further improve the vision for reading and driving, is quite possible with the passage of time. It is quite evident from both the studies that the level of satisfaction correlates well with the freedom from spectacle state.

It is reported that the most important reason for undergoing excimer laser treatment was to improve unaided vision (85.6%), or to be free from spectacles (83.3%), whereas 72.7% reported difficulties with contact lens wear as being very important. Improved unaided vision enabling subjects to participate (70%) in supports and improved cosmetic appearance (59.5%) were also considered important.

Brett Holliday did similar study; the questionnaire showed that between 15% and 30% of patients (depending on initial degree of myopia) were
disappointed with the result\textsuperscript{10}. Thus the level of satisfaction varies greatly from individual to individual\textsuperscript{11}. Our study showed that majority of patients were happy and satisfied with the final outcome at six months. A number of patients were not satisfied; either due to initial halo and night vision problems or with foggy vision and needed to wear glasses at times. But none of them was really unhappy or annoyed with the experience.

Shan et al tried to find out patient satisfaction level one year after PRK. Patients considered their results to be as follows: 82.3\% good or excellent, 14.9\% worthwhile, and 2.8\% were disappointed with the outcome. A high percentage of patients were satisfied with the outcome following PRK. However, a fair number (14\%) of patients considered the treatment to be worthwhile but it did not meet their expectations\textsuperscript{13}.

As much depend upon the patients expectations with the procedure, a patient with 6/6 visual acuity may not be satisfied owing to problems of glare and halos around light source\textsuperscript{12}. These problems resolve over the time and can be reduced significantly by avoiding eccentric ablation and using larger ablation zone diameter. The satisfaction and acceptance of the postoperative results can be much improved by improving on the preoperative consultative process, which must include the reason for seeking the treatment to determine the level of expectation of patient with the procedure, generally decline from low to high myopia.

But dissatisfied patients are seen in every refractive group\textsuperscript{10}. It is best to describe the outcome specific activities rather than an achieved level of visual acuity such as vision that is good enough to play sports, watch TV, and drive a car without correction. But glasses for reading, night driving, or bad weather driving may be required sometimes\textsuperscript{11}.

CONCLUSION:

Taking in to account the range of myopia treated, the level of satisfaction six months after PRK was generally high and quite encouraging in this survey. Subjective visual symptoms such as night vision problems and halo phenomenon did not have significant influence on overall patient satisfaction.

REFERENCES:

ABSTRACT

Objective: Retinopathy of prematurity (ROP) is emerging as a significant avoidable cause of childhood blindness in developing countries. This study was conducted to assess the referral system for ROP in the leading health care centers involved in the provision of services to newborns in Peshawar, and to assess the awareness of this condition among health care workers in these centers.

Methods: A purposeful sampling technique was employed to select ten health care centers in Peshawar, Pakistan, which had the highest number of deliveries per year. Key informants interviews were held with the health care providers involved in the decision-making at these centers. A content analysis was performed on their responses.

Results: A total of 10 physicians (2 neonatologists and 8 pediatricians) were interviewed. Most of the surveyed centers did not have any referral system for ROP. The two centers that did have a referral system were not following standard protocol for such referrals. Most interviewees had inadequate knowledge of ROP. Only 3 out of 10 physicians were aware that ROP can lead to blindness.

Conclusion: There was no referral system for ROP screening at most of the surveyed centers. The few centers that did have a referral system were not following international screening guidelines for such referrals. There is lack of recognition of ROP as a sight-threatening condition as shown by the inadequate knowledge of ROP among the concerned staff.

Key Words. Retinopathy of prematurity (ROP), low birth weights (LBW)

INTRODUCTION

Retinopathy of prematurity (ROP) is an important cause of childhood blindness which can lead to a lifetime of social, emotional and economical challenges. Currently, at least 50,000 children worldwide are blind from ROP. Its major risk factors include prematurity, low birth weight and exposure to high oxygen concentration.

The proportion of children who are affected by ROP varies depending on the level of development of the country and the effectiveness of ROP screening programmes in place. With improved survival rates of premature and low birth weight infants, especially in the developing countries, ROP is emerging as an important cause of blindness in children worldwide. This has been referred to as the “third epidemic” of ROP. However, if appropriate screening strategies are implemented, it is a potentially avoidable cause of blindness.

A key strategy used by ROP screening programmes is the timely referrals of high risk children. The idea of this study stems from our experience of seeing several cases of advanced ROP as a result of delayed referral. All these children were high-risk for ROP but their parents were not made aware by health care providers of the condition, its management and blinding consequences. They were all born in the leading hospitals of Peshawar, reportedly adequately equipped to deal with premature births. Based on this experience, we conducted a study in the 3 leading health care centers across Peshawar to assess if they had a referral system for ROP. We also assessed the level of awareness of this condition among health care workers directly involved in decision-making and provision of services to the newborns in these centers.

Methods

A purposeful sampling technique was employed to select 3 hospitals in Peshawar with the highest number of deliveries per year (Table 1).

The selected centers included private and public sector hospitals and maternity homes in different localities of the city, catering to large populations. Informed written consent to conduct the study was obtained from the administrators of the respective centers. In each center, information about referrals for ROP and related practices, and whether a standard protocol was being followed, were obtained from two paediatricians or neonatologists, involved in the primary decision making regarding the care of all...
newborns. We assessed if the selected centers were following a standard protocol for ROP screening. By standard protocol we mean, the joint statement on screening guidelines for preterm infants, which was issued by the American Academy of Ophthalmology, Section on Ophthalmology, American Academy of Pediatrics, & American Association for Pediatric Ophthalmology and Strabismus in 2006. These guidelines recommend that “infants with a birth weight of less than 1500 g or with a gestational age of 32 weeks or less (as defined by the attending neonatologist) and selected infants with a birth weight between 1500 and 2000 g or gestational age of more than 32 weeks with an unstable clinical course, including those requiring cardiorespiratory support and who are believed by their attending paediatrician or neonatologist to be at high risk, should have retinal screening examinations performed after pupillary dilation using binocular indirect ophthalmoscopy to detect retinopathy of prematurity (ROP).” Each interview lasted for around half an hour. The interview with the primary decision makers also asked open-ended questions about their awareness and practices (Appendix-1).

Relevant records and documents were examined and field notes were taken through interviews and document reviews. Content analysis technique was used to identify key features from the responses given by the interviewees regarding their practices of dealing with preterm infants. The typical responses that were obtained have been discussed here.

**RESULTS**

A total of 3 centers providing maternity services in Peshawar were invited to participate in the study. All decided to participate. The annual number of babies born ranged from approximately 700 to 16,000 (Table-2).

A range of responses were obtained for the questions we asked at these centers (Table-3).

**Ophthalmic referral system for premature babies:**

Most (8 out of 10) of the surveyed centers did not have any referral system for ROP. The two centers that did have a referral system were not following standard protocol for such referrals. Prematurity and low birth weights were not considered reasons for referral to an ophthalmologist. Generally if the baby was stable, regardless of gestational age, no advice was given other than for follow up with a paediatrician. At a hospital where approximately 7200 deliveries take place a year, the neonatologist said:

**Table 1:**
Characteristics of the surveyed hospitals and maternity homes in Peshawar

<table>
<thead>
<tr>
<th>Centre (Hospital/ Maternity Home)</th>
<th>Public/Private sector</th>
<th>No. of deliveries per year*</th>
<th>No. of preterm births per year*</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Public</td>
<td></td>
<td>7,000</td>
<td>1200-1400</td>
</tr>
<tr>
<td>B Public</td>
<td></td>
<td>9,000</td>
<td>1200-1800</td>
</tr>
<tr>
<td>C Public</td>
<td></td>
<td>16,000</td>
<td>3000-3600</td>
</tr>
</tbody>
</table>

*Average number of deliveries and preterm births as reported by the respective centers

**Appendix 1**

1. What advice would you give to the parents of a baby with gestational age ≤32 weeks or birth weight ≤1500 grams?
2. What are the criteria for giving oxygen to babies in your center?
3. If oxygen is given, what is the usual saturation and duration in your center?
4. What do you think could be the benefits and adverse effects of giving oxygen?
5. Have you ever heard of retinopathy of prematurity? If yes, what have you heard?
6. Do you routinely advise an eye examination for premature babies? If yes, at what age?

**Table 2:**
Key findings of the study

- Most of the surveyed hospitals did not have any referral system for ROP screening.
- Prematurity and LBW are not considered as reasons for giving an ophthalmologic referral.
- If a preterm and LBW baby is stable no advice is given to the parents besides follow up with the paediatrician.
- Though healthcare providers were aware of ROP, the extent of awareness was minimal.
- The most common misperception is that only those premature babies who are given oxygen are at risk of developing ROP.
- In the 2 hospitals where preterm, low birth weight (LBW) infants were given ophthalmologic referral, the timing for the first ophthalmologic visit was not in accordance with international guidelines.
- Although most doctors were aware that excessive exposure to oxygen could lead to eye problems, the oxygen saturation and duration of oxygen therapy were not properly standardized.

**Table 3:**
Response by the Physicians

<table>
<thead>
<tr>
<th>Responses</th>
<th>n = 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>No advice is given other than follow up with the paediatrician if a premature baby is stable</td>
<td>16</td>
</tr>
<tr>
<td>We routinely refer preterm, low birth weight infants for eye examination</td>
<td>4</td>
</tr>
<tr>
<td>Oxygen was given if the baby was in distress, appeared cyanosed and oxygen saturation was less than 85-90%</td>
<td>20</td>
</tr>
</tbody>
</table>
“We do not advise parents to have their child’s eyes examined, unless the baby was given oxygen which would lead to retrolental fibroplasia. In that case we advise them to visit an ophthalmologist, or we advise an eye examination if there is any ‘obvious abnormality’. But we do perform eye examination on every baby ourselves as well.” When asked when the first eye examination on a new born baby should take place, the interviewee replied that the timing depends on the parents. At one of the hospitals where premature babies were regularly seen by an ophthalmologist, the senior registrar said that he was not sure of the age at which the child was seen by an ophthalmologist. A major misconception among the interviewees was that only those premature babies who received oxygen were at risk of developing ROP. Only few were aware that ROP can lead to blindness. Another pediatrician cited “discharge from their baby’s eyes” as the reason for referral to an ophthalmologist.

In another hospital where nearly 800 babies were born annually, the paediatrician said that parents were advised to have their baby’s first eye examination at 6-8 weeks of life. One center that did have a referral system were not following standard protocol for such referrals. In one of these hospitals, all babies in the Neonatal Intensive Care Unit with birth weight less than 1500 grams were examined by a visiting ophthalmologist once a week. One maternity home, which caters to a large population of a very low socioeconomic stratum, where nearly 9600 deliveries take place per year, the pediatrician said. “Giving advice for eye examination is useless as no ophthalmologist visits our hospital from the institutes where [expertise in ROP management] exist. How can we refer our children? Our patients cannot afford to and will not seek any medical care outside of this charity hospital.”

**Availability and use of oxygen therapy:**

All surveyed hospitals had incubators. 10 out of 10 physicians we interviewed mentioned that oxygen was given if the baby was in distress, appeared cyanosed and oxygen saturation was less than 85-90%. However, in one out of ten hospitals premature babies were not given oxygen if they did not have any signs of respiratory distress. According to most interviewees, duration of oxygen therapy depended on the condition of the baby.

Regarding the appropriate use of oxygen in the preterm infants, in 2 out of the 3 selected centers the practice was to maintain oxygen saturation above 95%. However, some of the centers reported not monitoring oxygen saturation levels because of lack of human and capital resources to do so. Instead, the practice was to give 1 to 2.5 liters of oxygen per minute till baby’s condition improved.

Regarding the harmful effects of supplemental oxygen, the common responses were damage to lungs due to hyperoxia, retinopathy, metabolic alkalosis and free radical injuries. Fourteen physicians said that they were aware that excessive exposure to oxygen can have harmful effects on the brain and eyes.

**Awareness of ROP and its risk factors:**

When asked if they had ever heard of ROP and what its main risk factors were, majority of the respondents were aware of the fact that it was a condition of premature infants with excessive exposure to supplemental oxygen being the main risk factor. However, only few mentioned that it can result in irreversible blindness. Several interviewees confessed to having no or very little knowledge of the condition. As one senior doctor, where nearly 9000 deliveries occur per year, said: “Yes, I have heard of ROP, but I do not know anything about it.”

A pediatrician in a maternity home where 3000-3600 babies are born per year, with 120-240 preterm, LBW infants said: “I have as much knowledge [of ROP] as a final year MBBS student. I am aware of the pathophysiology and outcome. Every child who is given oxygen should have an eye examination.”

**DISCUSSION**

Our study revealed that majority of the leading health centers and maternity homes in KPKs’ largest city, Peshawar, do not refer preterm and low birth weight infants at risk of developing ROP to an ophthalmologist. Majority interviewees, irrespective of where they worked, showed inadequate knowledge of ROP, its risk factors and screening. Timely referral of the high risk babies is critical as it prevents the occurrence of threshold disease as recommended by guidelines titled, Screening examination of premature infants for retinopathy of prematurity. Ocular examination of premature infants should be performed by an ophthalmologist trained to deal with preterm infants, with sufficient expertise and knowledge to be able to identify the location and sequence of the disease. “The International Classification of Retinopathy of Prematurity Revisited” should be used as a guideline for recording these retinal findings. The first examination should normally be performed between 4 and 6 weeks of post natal age and the follow up examinations should be scheduled by the examining ophthalmologist. However, it was disturbing to note that in our study prematurity and low birth weights were not considered as reasons for advising neonatal ophthalmologic examination. In addition, the majority of interviewees were not aware of its pathology, risk factors and consequences. We identified a number of misperceptions, the most common being that only those premature babies who were given oxygen therapy were
at risk of developing ROP. To date, there is insufficient evidence to suggest what the optimal oxygen saturation is or PaO2 values to aim for in preterm infants who receive oxygen. Research has shown that despite the common belief that oxygen therapy increases the risk of ROP, it can occur even with carefully controlled oxygen therapy and therefore, prematurity is the most important risk factor.2

In two hospitals where ophthalmologic referral was given for premature, low birth weight infants, the timing for the first ophthalmic visit was not in accordance with international guidelines; parents were advised to visit an ophthalmologist either at 6-8 weeks after birth, immediately after first visit to a pediatrician or no time frame was given. Lack of attention to ROP as an important cause of childhood blindness in medical curriculum and the limited number of trained people in neonatal care may explain these misconceptions. A prior local study, which reported the incidence of ROP as 32.4% in a tertiary care center, revealed that a large number of infants who satisfied the screening criteria remained unscreened in our country and could have developed ROP with consequent blindness.7 Thus, implementation of proper screening guidelines in hospitals and maternity homes with special focus on the education of staff involved is essential.

According to World Health Organization — Vision 2020 program, after corneal scarring and cataract, ROP is one of the leading causes of avoidable childhood blindness worldwide.1 Due to improvements in neonatal care in the developing world, more premature infants are surviving. Thus ROP is emerging as a cause of blindness in middle and low-income countries. Prematurity and low birth weights are important issues in our country contributing to infant morbidity and mortality. In Pakistan 35% of neonatal mortality is due to prematurity and related complications.8 With improvements in neonatal care, more premature infants are now surviving in developing countries such as ours. Therefore, there is a much greater percentage of population that is “at risk” of developing Retinopathy of Prematurity in our part of the world. Due to limited resources the economic burden of the disease is also higher in such countries.

An important question which arises is that who should be making the decision for referral in these centers and where these babies should be referred to. Unless there are appropriate ROP services available with effective linkages to maternity homes and other health care facilities, referrals cannot be meaningful. In industrialized countries, effective screening programmes and high standard of neonatal care has resulted in reduced rates of blindness due to ROP.1 Screening programmes are also being implemented in India, however they show a need to develop region specific guidelines.9,10

A strength of our study was that it involved all major hospitals and maternity homes with the highest rates of births, in all the major parts of the city. It would be important to see if the same pattern of inadequate knowledge of ROP and variable referral system exist in smaller units. A qualitative methodology was chosen because this topic is not very well explored in our part of the world. Such a method was useful in providing an in-depth understanding of the issues explored.

One limitation of our study was that we could not confirm the reliability of the responses we obtained since we did not directly observe the practices regarding ROP referrals in the selected centers and our conclusions are based on the responses we received from the health care providers in these places.

CONCLUSION

In conclusion, there is no referral system for premature infants at the surveyed hospitals and maternity homes which have the highest number of deliveries in the city. There is lack of recognition of ROP as a sight-threatening condition as shown by the inadequate knowledge of ROP among the concerned staff.

We recommend that all at-risk babies born in hospitals and maternity homes should be registered and be automatically referred to ophthalmologists. Staff involved in the care of premature infants should be trained in ROP through workshops and seminars. Parents of all prematurely born babies should be informed about the risk of development of ROP, and the importance of timely ophthalmologic review and follow-up should be stressed. The importance of a critical time window for successful treatment and blindness as a possible consequence of untreated disease should be emphasized.

REFERENCES

6. The International Classification of Retinopathy of
Comparison of Preoperative Injection vs. Intraoperative application of Mitomycin C in Recurrent Pterygium*

Zakir Hussain1, Hamid ur Rehman2
Muhammad Bilal3

Objectives: to study the efficacy of preoperative subconjunctival injection of mitomycin C with intraoperative mitomycin in recurrent pterygium

Study design: Randomize control trial.

Place and duration of study: The study was carried out at Eye Unit, District Headquarter Hospital, Lakki Marwat between May 2011 and November 2011.

Patients and methods: Patients underwent full preoperative evaluation (complete history and ophthalmological examination). Patients were randomly divided into two groups. In group A, 20 eyes received 0.1 ml of 0.20 mg/ml Mitomycin C injected subconjunctivally into the head of the pterygium one day before surgical excision using the bare sclera technique. In group B, 20 eyes underwent surgical removal with the bare sclera technique and intraoperative topical application of 0.20 mg/ml of mitomycin C. Preoperative subconjunctival injection of mitomycin C (MMC) was done at the outpatient clinic under aseptic conditions one day before surgery.

Results: The study included 40 eyes divided into two groups. Both groups had recurrent pterygium encroaching onto the cornea (3 to 5 mm in size) that had been operated within one year prior to inclusion. The mean preoperative best corrected visual acuity (BCVA) was 0.53 th + 0.15 in the group A and 0.58th + 0.20 in the group B upon inclusion into the study. The mean postoperative BCVA was 0.8 + 0.11 in the group A and 0.83+ 0.16 in the group B. There was a highly statistically significant difference between the preoperative and postoperative results (P<0.05), while the difference between the two groups was statistically insignificant (P>0.05) One year postoperatively, the recurrence rate was one (5%) eye in the group A (a 5-mm pterygium that was removed after reported growth by the patient) and two (10%) eyes in the group B (a 4-mm pterygium that was removed for proximity to visual axis and a 3-mm pterygium that was removed after reported growth by the patient). The difference in the recurrence rate between both groups was statistically insignificant (P>0.05)

Conclusions: Preoperative subconjunctival injection of mitomycin C in low dose (0.1 ml of 0.20 mg/ml) a day before pterygium surgery is a simple and effective modality for management of recurrent pterygium.

Key words: Pterygium, Mitomycin C

INTRODUCTION

Pterygium is a common external eye disease, seen more frequently in tropical and subtropical areas where exposure to ultraviolet sunlight is high. Pterygium creates many problems for the patient including symptoms of irritation, foreign body sensation and lacrimation, cosmetic disfigurement, and functional problems such as reduced visual acuity, diplopia and problems fitting contact lenses. The main histopathological change in primary pterygium is elastodysplasia and elastodystrophy of subepithelial connective tissue. The exact cause of pterygium is not well understood. However, long-term exposure to sunlight, especially ultraviolet rays and chronic eye irritation from dry, dusty conditions seem to play an important role. Surgical treatment of pterygium is directed at excision, prevention of recurrence and restoration of ocular surface integrity. Simple excision of the pterygium alone has a very high rate of recurrence, about 30-70%. Even conjunctival autografting to cover the bare sclera is associated with recurrence rates of 2% - 39%. Various adjunctive strategies such as irradiation treatment, antimetabolites, conjunctival autograft, limbal autograft and amniotic membrane graft have been employed over the years to reduce the high recurrence rate. In the last decade, mitomycin C had been used more commonly in pterygium surgery. The mechanism of action of mitomycin C seems to inhibit fibroblast proliferation at the level of the episclera. The use of intraoperative application of mitomycin C gives a high success rate, however, serious complications have been reported. Subconjunctival injection of mitomycin C as adjunctive therapy before surgery allows exact titration of mitomycin C delivery to activated fibroblasts and

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minimizes epithelial toxicity. We designed this study to compare the efficacy of preoperative injection versus intraoperative application of mitomycin C in recurrent pterygium surgery.

**MATERIAL AND METHODS**

A randomized comparative case series study was conducted between May 2011 and November 2011 in Eye Unit, District Headquarter Hospital, Lakki Marwat; where 40 eyes of 40 patients with recurrent pterygium following simple excision were included in the study. Patients with other ocular surface diseases, dry eye and progressive ocular disease unrelated to corneal condition were excluded from the study. Patients underwent full preoperative evaluation (complete history and ophthalmological examination). Patients signed an informed consent after complete discussion of the procedure before included in the study. Patients not coming for follow-up were excluded from the study.

Patients were randomly divided into two groups. In group A, 20 eyes received 0.1 ml of 0.20 mg/ml mitomycin C injected subconjunctivally into the head of the pterygium one day before surgical excision using the bare sclera technique. In group B, 20 eyes underwent surgical removal with the bare sclera technique and intraoperative topical application of 0.20 mg/ml of mitomycin C (MMC) was done at the outpatient clinic under aseptic conditions one day before surgery. With the patient in supine position and magnifying loupe, surface anesthesia was achieved by benoxinate 0.4% eye drops; then eye speculum was applied and MMC was injected into the head of the pterygium at the limbus using 30G needle followed by pressure with micro-sponge to prevent drug leakage and irrigation with 50ml balanced salt solution. Ofloxacin 0.3% and dexamethasone 0.1% eye drops (four times/day) were prescribed and the eye was patched for one day before scheduled surgery next morning. Patients underwent pterygium excision by bare sclera technique in the operating room under surgical microscope. After preparing and draping the eye in normal sterile fashion, the lids were opened using eye speculum. Surface anesthesia was achieved with Alcaine eye drops. Lignocaine 0.5 ml of 2% solution was injected into the pterygium. The head of the pterygium was grasped with toothed forceps and excision was done with No. 15 Bard-Parker blade about 0.5 mm ahead of the pterygium and carried down clearly to the limbus. The conjunctiva and subconjunctival tissue were then cleaned over the sclera towards the insertion of the medial rectus muscle and excision of the pterygium was carried out to 4 mm posterior to the limbus. Hemostasis was ensured. No conjunctival sutures were used.

In the group A, intraoperative eye irrigation with 200 ml of balanced salt solution was done following pterygium excision to wash out residual subconjunctival MMC. In the group B, intraoperative application of mitomycin C was done using 5-mm surgical sponge soaked with 0.20 mg/ml mitomycin C solution and placed on the exposed scleral surface for 2 min. After the sponge was removed, the eye surface was irrigated with 200 mL of balanced salt solution. Postoperative treatment included ofloxacin 0.3% and dexamethasone 0.1% eye drops (four times/day) and combined tobramycin and dexamethasone eye ointment at bedtime for four weeks in both groups.

Postoperative follow-up visits were scheduled one day, one week, one month, two months, three months, six months and 12 months after surgery. In each visit, complete ophthalmological examination was done with special attention to pterygium recurrence and complications of mitomycin C such as corneal edema, glaucoma, corneal or scleral melting, keratitis and cataract. Recurrence of pterygium was defined as a fibro-vascular growth beyond the limbus into the cornea with conjunctival drag. Data was coded, entered and analyzed using SPSS Version 10.0 software for analysis.

**RESULTS:**

The study included 40 eyes divided into two groups. The group A consisted of 9 (45%) women and 11 (55%) men with mean age 30.15±15.57 years. While the group B consisted of 12 (60%) women and 8 (40%) men with mean age 33.11±114.23 years. Both groups had recurrent pterygium encroaching onto the cornea (3 to 5 mm in size) that had been operated within one year prior to inclusion. The indications for pterygium surgery are shown in Table I. There was no statistical difference (P>0.05) between the two groups as regarding the age and sex. So the two groups were statistically comparable. The mean preoperative best corrected visual acuity (BCVA) was 0.53 th + 0.15 in the group A and 0.58th + 0.20 in the group B upon inclusion into the study. The mean postoperative BCVA was 0.8 + 0.11 in the group A and 0.83+ 0.16 in the group B. There was a highly statistically significant difference between the preoperative and postoperative results (P<0.05), while the difference between the two groups was statistically insignificant (P>0.05).

One year postoperatively, the recurrence rate was one (5%) eye in the group A (a 5-mm pterygium that was removed after reported growth by the patient) and two (10%) eyes in the group B (a 4-mm pterygium that was removed for proximity to visual axis and a 3-mm pterygium that was removed after reported growth by the patient). The difference in the recurrence rate between both groups was statistically insignificant (P>0.05). Recurrence of pterygium was noted three to five months postoperatively. As regards postoperative
complications, delayed epithelization (more than two weeks) occurred in two eyes (10%) in the group A and in one eye (5%) in the group B. Scleral thinning was reported in one eye (5%) in the group B which occurred at one month and resolved within three weeks under conservative treatment with topical lubricant therapy; no other serious postoperative complications were reported.

DISCUSSION:

Simple excision of pterygium is associated with a high recurrence rate ranging from 30 to 70%. To reduce this high recurrence rate, different methods like, beta irradiation, mitomycin C, and amniotic membrane have been used. However, serious complications such as secondary glaucoma, uveitis, scleromalacia and corneal perforation are associated with these methods. Mitomycin C is commonly recommended to reduce recurrence. Mitomycin C is an antineoplastic antibiotic with radiomimetic properties, that selectively inhibit DNA, RNA and protein synthesis. Adjunctive mitomycin C (MMC) in pterygium surgery was first described in Japan by Kunitomo and Mori in 1963. Since then several modalities of usage have been described including preoperative injection and intraoperative application. MMC is an effective intraoperative treatment for preventing recurrence of pterygium.

The effect of the drug depends on the dose and the time of application. Unfortunately, complications from intraoperative MMC application in pterygium surgery have been reported including vision-threatening complications such as glaucoma, corneal edema, corneal perforation, scleral melting, and cataract formation. Subconjunctival application of MMC allows exact dose delivery with minimal epithelial and scleral toxicity. Subconjunctival MMC was investigated in animal models, glaucoma, ocular cicatricial pemphigoid and pterygium surgery without serious complications.

The concept of the study originated from a previous study by Donnenfeld and co-workers who reported a case series of subconjunctival MMC injection one month before surgery in recurrent pterygium. Their results showed that pterygia were less vascular and less inflamed at one month and all pterygia were quiescent at the time of surgical excision. However, the recurrence rate was comparable to previous studies with MMC application. The major endpoint of pterygium removal relates to recurrence. As long as there are no evidence-based guidelines to relate recurrence to the surgical indications or characteristics of the pterygium, judging on the effective duration between MMC injection and surgery on the basis of changes in pterygium characteristics will be unsupported, as recurrence rate will remain the final decision of any duration. Good penetration of MMC following topical application was documented in animal models through either intact or non-intact corneal epithelium. The aqueous humor concentration of MMC increased in a dose-dependent manner with increasing exposure time and application concentration. Based on these reports of ocular penetration of MMC, the drug could be detected in the aqueous humor 10 min after topical application, and could penetrate the eye more easily through non-intact epithelium like that following pterygium excision. A study of low-dose MMC through subconjunctival injection with shorter duration of exposure before pterygium excision seemed logic to maintain the efficacy of the drug and avoid long unnecessary exposure with subsequent penetration of MMC.

In our comparative case series the recurrence rate was 5% in the group A and 10% in the group B. These results are considered as effective as other modalities of preoperative and intraoperative adjuvant MMC in recurrent pterygium, and better than some reports like Luanratankorn and co-workers who reported a recurrence rate 52.6% with amniotic membrane transplantation and 21.4% with conjunctival autograft for recurrent pterygium after a six-month follow-up period. Recurrence rates reported with intraoperative MMC application as adjuvant treatment in recurrent pterygium surgery ranged from 12.5-42.9% depending on the MMC concentration and duration of application. Combining conjunctival advancement or graft with intraoperative MMC reduced recurrence rates and improved safety.

In the clinical non-comparative case series of Donnenfeld and co-workers, 36 eyes with recurrent pterygium received 0.1 ml of 0.15 mg/ml MMC subconjunctivally one month before surgery; the reported recurrence rate was 6% over a mean follow-up of 24.4 months. In another trial preoperative injection of MMC into primary pterygium one month prior to combined pterygium and cataract surgery.

### Table I Indication of surgery

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Indication for surgery</th>
<th>Group A (No of eyes)</th>
<th>Group B (No of eyes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Decrease Visual acuity</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>Reported growth by patient</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>Symptoms of irritation</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>
Comparison of Preoperative Injection vs. Intraoperative application of Mitomycin C in Recurrent Pterygium

resulted in no recurrence and no serious complications up to 23 months of follow-up.\textsuperscript{23}

As regards postoperative complications, only one eye (5\%) had mild avascular scleral thinning in the group B that resolved within three weeks after surgery and no other serious complications were reported. Complications occurring after pterygium surgery with adjunctive MMC have been well reported with different modalities of application, concentrations and durations. Avascularized scleral thinning was reported in 13 out of 36 eyes (34.2\%) following the use of topical MMC 0.02\% eye drops after primary pterygium excision.\textsuperscript{24}

Carrasco and co-workers reported local scleral necrosis in a patient who received subconjunctival 0.15 mg/ml MMC one month before pterygium excision. However, that patient had severe dry eye with history of punctal cauterization.\textsuperscript{25} These findings should be seen in consideration of the limitation of our work including the small number of patients in each group which probably limited the value of the statistical comparison. Further research to assess endothelial toxicity, intraocular pressure changes and long-term follow-up following subconjunctival MMC injection is required to judge its safety and efficacy. Preoperative subconjunctival low-dose MMC injection one day before bare sclera excision showed encouraging clinical results in the management of recurrent pterygium in appropriate patient population with comparable success to topical application of mitomycin. The subconjunctival injection negates the ability of tear film to dilute the medication, increasing exposure time to the subconjunctival tissue and decreasing the ocular penetration through the intraoperative keratectomy.

CONCLUSION:

Preoperative subconjunctival injection of mitomycin C in low dose (0.1 ml of 0.20 mg/ml) a day before pterygium surgery is a simple and effective modality for management of recurrent pterygium. It has the advantage of low recurrence and complications rate.

REFERENCES:

Frequency of Different Types of Age Related Cataracts  
(Study of 250 cases)

Naseer Ahmad DOMS¹, Faisal Nawaz Khan FCPS², Mohammad Alam³,  
Mohammad Idris⁴, Muddasir Hussain⁵

ABSTRACT

Objective: To find out the frequency of different types of age related cataracts in patients admitted for cataract surgery at department of Ophthalmology, Khyber Institute of Ophthalmic Medical Sciences (KIOMS), Lady Reading Hospital Peshawar.

Materials and Methods: This study was conducted at department of Ophthalmology, Khyber Institute of Ophthalmic Medical Sciences (KIOMS), Lady Reading Hospital Peshawar, from April 15, 2011 to November 15, 2011. Approval was taken from ethical committee of Post Graduate Medical Institute (PGMI), Peshawar, before starting the study. 250 patients suffering from age-related cataract (with age range from 40 to 83 years) were selected, in which 128 (51.2%) were male and 122 (48.8%) were female. An informed written consent was obtained from each patient. The patients evaluated for inclusion criteria. A proper proforma was designed for evaluation and documentation of patients. Anterior segment and if possible posterior segment examination was done with direct, indirect ophthalmoscope and slit lamp bimicroscopy. After dilation of the pupil (in individuals judged not to have occludable angles), the patient were graded as nuclear, cortical, and posterior sub capsular cataract by comparison with standard photographs based on the WHO adaptation of the Lens Opacity Classification System III (LOCS III). The cases that satisfied the inclusion and exclusion criteria were included.

Results: In our study the posterior sub capsular cataract (PSC) 142(56.8%) is the most common entity followed by nuclear cataract 66(26.4%) and finally is the cortical cataracts 42(16.8%). According to the Lens Opacity Classification System III (LOCS III) of cataracts, in the sub types of cortical cataracts cases 42(16.8%) mostly the patients presented in Grade 3 (> 4 mm) 17(40.48%) but the same ratio of patients 10(23.81%) presented in Grade 0 (an opacity < 1 mm in vertical diameter) and Grade 2 (between 2 and 4 mm) of cortical cataracts. In the sub types of Nuclear cataract (NC), 66(26.4%) cases, mostly the patients also presented in Grade 3 (is at least as extensive as standard photograph 3) 26(39.39%) and Grade 2 (defined in analogous fashion with regard to standard photographs 2 and 3) 25(37.89%) nuclear cataracts. The percentage of grades show that Grade 2 and Grade 3 patients presented almost in the same ratio. While the sub types of Posterior Sub capsular Cataract (PSC) 142(56.8%) cases, mostly the patients presented in Grade 3 (greater than one half of lens circumference) 61(42.96%) and Grade 2 (one fourth to one half of cortical circumference) 42(29.57%) cortical cataracts. In our study most of the respondents observed is having Grade 2 and Grade 3 of different types of age related cataract followed by Grade 4. While the Grade 1 and Grade 0 presented very rarely except in the cortical cataract.

Conclusion: the posterior sub capsular cataract 142(56.8%) is the most common entity followed by nuclear cataract 66(26.4%) and finally is the cortical cataract 42(16.8%).

Abbreviation / Key words: Visual acuity (VA), Best corrected visual acuity (BCVA), Posterior Sub capsular (PSC), Cortical Cataract (CC), Nuclear Cataract (NC), Lens Opacity Classification System III (LOCS III)

INTRODUCTION

Globally, cataract accounts for 50% of blindness and remains the leading cause of visual impairment all over the world. Among the ocular ailments, a large backlog of cataract blindness exists in the developing countries and cataract is the most common cause of reversible blindness. This ocular morbidity is the leading cause of blindness in the world and about 18 million people are being affected by cataract²,³ despite improvements in surgical outcomes (WHO 2005). The underprivileged population of the world fails to avail eye care services and the most important barriers are insufficient financial resources, lack of awareness about existing eye care facilities and inaccessibility⁴,⁵,⁶. Cataract surgery has been in evolution phase from couching in the ancient times by Susruta to reaching at the dawn of Kelman method of surgery who is the pioneer of recent advanced technique of Phacoemulcification and launched in 1967. Despite what modern technology has done to advance the treatment of cataract, the greatest challenge in our field continues to be the large and increasing backlog of cataract blindness in the developing countries.⁷ This number is expected to rise due to an aging population and increase in life expectancy. Cataract, an opacification of the crystalline lens in the eye, can be caused by many factors including the natural aging process, metabolic abnormalities,
nutritional disorders, chronic ocular inflammation and trauma. Many causes of cataract are classified by their morphology like size, shape, location or etiology. Age related cataract is the one related with old age. In a survey conducted in Pakistan, the prevalence of cataract in 16402 adults above the age of 30 years (20.9%) mainly associated with the increasing age. The fact that the pattern in a large proportion, different grades of cataract were seen amongst older people as observed in many US-based populations. The incidence of higher age group rates of nuclear and cortical cataract has been reported for women in previous population-based studies among both African and European populations. This finding is not completely understood. One hypothesis is that changes in the hormonal milieu at menopause somehow increase the risk of lens opacity among women. Evidence in favor of this theory includes a decreased risk of nuclear sclerosis among current users of estrogen replacement therapy and a protective effect of younger age at menarche and older age at menopause against nuclear and cortical opacities, respectively.

The most prevalent form of cataract in African population is nuclear cataract (NSC). This differs from the preponderance of cortical cataract (CC), which has been reported for African-derived populations in Barbados and Maryland. One reason for this observed difference appears to be a low prevalence of CC in our study (8.8%) compared with either Barbados (34%) or Salisbury (54% for African-American subjects). Several different types of explanations may be considered for this. Differences in the prevalence rates of the different types of age-related lens opacity are of more than theoretical interest. The degree of visual disability associated with the different types of cataract has been reported to vary, with posterior sub-capular cataract (PSC) and NSC in particular being more likely to result in vision loss requiring cataract surgery. Diagnosis is made with ocular examination using slit-lamp biomicroscopy. Although cataracts are not preventable, their surgical treatment is one of the most cost-effective interventions in healthcare.

MATERIALS AND METHODS:
This hospital based cross sectional study was conducted at department of Ophthalmology, Khyber Institute of Ophthalmic Medical Sciences (KIOMS), Lady Reading Hospital, Peshawar, from April 15, 2011 to November 15, 2011. Purposive (Non probability Sampling) technique was used in this study.

Inclusion Criteria:
- All patients of age related cataracts of age less than 40 years.
- All the patients who declined to be interviewed.
- Approval was taken from ethical committee of PGMI Peshawar, before starting the study. 250 patients suffering from age-related cataract with age range from 40 to 83 years were selected, in which 128 (51.2%) were male and 122 (48.8%) were female. They were having relatively old age, with an average age of 58.58±11.56SD years. Regarding the sex of the patients 128(51.2%) patients were male and 122 (48.8%) were females (Table I). An informed written consent was obtained from the patient. The patients evaluated for inclusion criteria. A proper proforma was designed for evaluation and documentation of patients. Anterior segment and if possible posterior segment examination was done with direct, indirect ophthalmoscope and slit lamp bimicroscopy. After dilation of the pupil (in individuals judged not to have occludable angles), the patient are graded as nuclear, cortical, and posterior sub capsular cataract by comparison with standard photographs based on the WHO adaptation of the Lens Opacity Classification III System (LOCS III). The cases that satisfied the inclusion and exclusion criteria were included. Data was entered and analyzed using SPSS version 10. Mean and standard deviation were calculated for numerical variable i.e. age while percentages and frequencies were computed for categorical variable respondent / age of the patients, sex, main type and sub types of cataract etc. The entire variables were presented in the form of tables and charts.

RESULTS:
A total of 250 cases participated in this study. Age of the respondents ranged from 40 to 83 years. They were having relatively old age, with an average age of 58.5 years. Regarding the sex of the patients 128(51.2%) patients were male and 122 (48.8%) were females (Table I). In our study the presenting visual acuity of the 176 (73.2%) cases were between the visual acuity of 6/24 and 1/60, Hand Movement (HM) of 44(17.6%) and Projection of light (PL) of remaining 23(9.2%) cases (Table II). This shows that mostly the presenting visual acuity was between 6/24 and 1/60 (Counting Finger one meter).

In the frequency of different types of age related cataracts, the Posterior Sub Capsular cataract cases 142(56.8%) are the most common followed by nuclear cataract 66(26.4%) and finally is the Cortical cataract 42(16.8%) (Table III).

According to the Lens Opacity Classification System III (LOCS III) of cataracts, in the sub types of cortical cataracts cases 42(16.8%) mostly the patients...
presented in Grade 3 (> 4 mm) 17(40.48%) but the same ratio of patients 10(23.81%) presented in Grade 0 (an opacity < 1 mm in vertical diameter) and Grade 2 (between 2 and 4 mm) of cortical cataracts. (Table IV)

In the sub types of Nuclear cataract (NC), 66(26.4%) cases, mostly the patients also presented in Grade 3 (is at least as extensive as standard photograph 3) 26(39.39%) and Grade 2 (defined in analogous fashion with regard to standard photographs 2 and 3) 25(37.89%) nuclear cataracts. The percentage of grades show that Grade 2 and Grade 3 patients presented almost in the same ratio. (Table V) While the sub types of Posterior Sub capsular Cataract (PSC) 142(56.8%) cases, mostly the patients presented in Grade 3 (greater than one half of lens circumference) 61(42.96%) and Grade 2 (one fourth to one half of cortical circumference) 42(29.57%) cortical cataracts. (Table VI) In our study most of the respondents observed is having Grade 3 and Grade 2 of different types of age related cataract followed by Grade 2. While the Grade 1 and Grade 0 presented very rarely except in the cortical cataracts. 

**DISCUSSION:**

In the present study, it was observed that older people aged between 40 -83 years especially men are most likely to develop age related cataract which may be associated to different conditions like Diabetes Mellitus and Hypertension etc. The burden of age related cataract was higher among the 60 years age group and above. Patients with cataract were significantly older (58.58 years). There were 52% male and 48% female with senile cataract out of the 250 cases studied. According to World Health Organization, cataract is the leading cause of reversible blindness and visual impairments in more than 17million (47.8%) of the 37 million blind individuals worldwide, and this number is projected to reach 40 million by 2020. (WHO 2005) and in the Beaver Dam Eye Study (BDES), the prevalence of cataract increases with age It reported that 38.8 % of men and 45.9% of women older than 75 years had visually significant cataract. (Klein et al. 1998).

In Pakistan, cataract formation is more commonly observed among adult subjects. It is the leading cause of avoidable blindness. The elderly suffer disproportionately with a loss of vision from eye diseases. The elderly are more likely to have ocular disease and suffer greater severity of the disease. Blindness has profound human and socio economic consequences in all societies.
The costs of lost productivity and of rehabilitation and education of the blind constitute a significant economic burden for the individual, the family and society. The number of cataract blind is expected to increase dramatically in coming decades as the number of elderly in the world’s population increases. In the absence of more widespread availability of cataract surgery in the developing world, or the identification of interventions that retard the development or progression of cataracts, population projections suggest that the number of cataract blind could reach close to 40 million by the year 2025.16

While cataract blindness is largely a problem in the developing world, where access to surgical intervention is often limited, blindness registry data collected by several US states as recently as 1970 suggested that cataracts were the third leading cause of blindness and accounted for about 9 percent of all blindness in the United States. Many changes in cataract management, including an extremely large increase in the number of cataract operations since 1970, have apparently reduced the number of cataract blind in developed countries.17 How ever, a recently published survey from East Baltimore indicated that un operated age-related cataract was the leading cause of blindness in blacks, accounting for almost one-third of all blindness in this population.18 In the United States, age-related lenticular changes have been reported in 42% of those between the ages of 52 and 64,19 60% of those between the ages 65 and 7420 and 91% of those between the ages of 75 and 85.19 Data from the Framingham Eye Study (FES) indicated that age-related changes increased to 91 percent for persons aged 75-85.In the same study, age-related cataract (cortical cuneiform opacities, nuclear sclerosis, posterior sub capsular opacities, aphakia), were present in 42 percent of persons aged 52-64.20 The prevalence of these changes increased to 91 percent for persons aged 75-85. In the same study, age-related cataract (cortical cuneiform opacities, nuclear sclerosis, posterior sub capsular opacities, aphakia) accompanied by a reduction in visual acuity to 6/9 or worse) ranged from 4 percent at age 52-64 to 50 percent at age 75-85.21 Eye examinations conducted during the 1971-72 National Health and Nutritional Examination Survey (NHANES) showed that approximately 60 percent of persons in the age group 65-74 years had lens opacities.14 The prevalence of lens opacities causing a decrease in vision to 6/7.5 or worse was 28 percent in persons aged 65-74. Few incidence data are available for age-related cataract. Podgor, Leske, and Ederer have used age-specific prevalence data from the Framingham Eye Study to estimate 5-year incidence rates for lens opacities and cataract.22 For lens opacities, the 5-year incidence estimates for ages 55, 60, 65, 70, and 75 were 10, 16, 23, 31, and 37 percent, respectively. The biochemical and structural changes that take place within the human crystalline lens have been likened to degenerative processes that occur in other parts of the body as a consequence of aging.

CONCLUSION:
About 50% of all 60-70 years old suffer from a cataract requiring surgery. More males are having age related cataracts than the females out of the 250 cases studies. Age related cataracts are mostly presented in Grade 2 and Grade 3 of different types of cataract. The most common type of cataract in our study population is Posterior Sub Capsular cataract as shown in Table III, although the cortical cataract is more prevalent in the black African community as discussed else where. The Grade 2 and Grade 3 of the LOCS III classification is more prevalent in our study, although Grade 0 of Posterior Sub capsular Cataract is also in age group of 60 years and above. This result was consistent with other study elsewhere and support the hypothesis that with the exception of confounders, cataractogenesis is connected to the aging process, associated with increased osmotic and oxidative stress, reduced efficiency of metabolic processes and a decline in antioxidant defenses.

REFERENCES:
Role of Intravitreal Bevacizumab in the Treatment of Acute Central Serous Chorio-retinopathy*

Zakir Hussain¹, Muhammad Tariq Khan²
Hamid ur Rehman², Ziauddin⁵

ABSTRACT
Objectives: To report the beneficial effect of intravitreal bevacizumab (Avastin) injection in patients with acute central serous chorioretinopathy (CSCR).

Place and duration of study: The study was carried out at private eye clinic in Said Anwar Medical Center, Dabgari Garden, Peshawar from March 2011 to August 2011.

Patients and methods: Patients with symptomatic CSCR of less than 6-months duration were prospectively recruited between March 2011 and August 2011. The diagnosis of CSC was established by the presence of serous macular detachment on fundus examination and fluorescein leak on fundus fluorescein angiography. Patients received only a single intravitreal injection of bevacizumab (1.25 mg in 0.05 mL), 3.5 mm from the corneal limbus, using a 27-gauge needle. The primary outcome of the study was the time measured from baseline to complete absorption of subretinal fluid during follow-up. Secondary outcome measures included serial changes in the logarithm of the minimum angle of resolution (logMAR) visual acuity and OCT.

Results: Fifteen eyes of 15 patients (10 men, 5 women) with CSCR were treated with intravitreal bevacizumab injection. Their age at the time of treatment ranged from 32 to 55 years (mean 43.4). Pretreatment visual acuity ranged from 20/25 to 20/100. All patients had complete or nearly complete clinical resolution of macular fluid and had improvement in visual acuity within 1 month after treatment. Mean pretreatment LogMAR visual acuity was 0.32 and improved to 0.04 at 6 months' follow-up, which was statistically significant. No patient lost vision or suffered from any significant complications related to the treatment.

Conclusions: Intravitreal bevacizumab injection for acute central serous chorioretinopathy may result in prompt resolution of neurosensory detachment and reduction of angiographic leakage. These short-term results suggest that intravitreal bevacizumab injection may constitute a promising therapeutic option in acute central serous chorioretinopathy.

Key words: Bevacizumab; Central serous chorioretinopathy.

INTRODUCTION
Central serous chorioretinopathy (CSCR) is one of the ten most common diseases of the posterior segment of the eye, involving serous detachment of the neurosensory retina occurs over an area of leakage from the choriocapillaris through the retinal pigment epithelium (RPE). In most of the patients, CSCR is self-limited, and visual prognosis is good. However, in some cases of CSCR, patients develop progressive visual loss due to persistent serous retinal detachment, cystoid macular degeneration, or retinal pigment epithelium decompensation. Clinicians usually elect to observe patients with acute CSCR, because these patients generally show self-remission, and standard treatments like laser photocoagulation or photodynamic therapy may cause complications. However, patients with acute CSCR often desire more rapid resolution of their disease.

The mechanism for the development of CSCR remains unclear. According to one of the hypothesized mechanisms, abnormalities in choroidal perfusion can be causative factors in CSCR. Recent indocyanine green angiography in patients with CSCR has demonstrated evidence of choroidal lobular ischemia and choroidal venous congestion, and also revealed multiple areas of choroidal vascular hyperpermeability in intermediate stages of the study. The cause of the venous congestion has not been determined, but it may be a response to ischemia and delayed arterial filling or a consequence of outflow obstruction. Choroidal hyperpermeability at foci of subretinal fluorescein leakage is a frequent finding, but choroidal hyperpermeability can also be found without associated fluorescein leakage, suggesting more generalized retinal pigment epithelium (RPE) or choroidal vascular disturbance. Vascular endothelial growth factor (VEGF) has been implicated as the major factor responsible for increased...
vascular permeability. Recently, bevacizumab (Avastin), an antibody to VEGF, has been shown to have anti-permeability properties. Intravitreal injection of bevacizumab (IVB) has been reported to be associated with visual improvement and reduced neurosensory detachment without adverse events in patients with CSC. In this study, we investigated the effect of IVB in patients with acute CSC.

**MATERIAL AND METHODS**

Patients with symptomatic CSC of less than 6-months duration were prospectively recruited between March 2011 and August 2011. The diagnosis of CSCR was established by the presence of serous macular detachment on fundus examination and fluorescein leak on fundus fluorescein angiography. Patients who had received any previous treatment, including photodynamic therapy or focal thermal laser photocoagulation for CSCR, or who had evidence of choroidal neovascularization, polypoidal chorio-retinopathy, or other maculopathy on clinical examination, fluorescein angiography, were excluded from the study. Informed consent was obtained from all subjects. Patients received only a single intravitreal injection of bevacizumab (1.25 mg in 0.05 mL), 3.5 mm from the corneal limbus, using a 27-gauge needle, in the inferotemporal quadrant under aseptic conditions. Eyes were injected less than one week after diagnosis in our clinic. Each patient underwent clinical assessments, including best-corrected visual acuity measurement in Snellen units, applanation tonometry, fundus examination, fluorescein angiography and optical coherence tomography (OCT) at baseline. Regarding follow-up, the patients were examined at 4-week intervals with slit-lamp biomicroscopy and OCT, and fluorescein angiography was performed at the discretion of the examiner. No other treatment for CSCR was performed during the study. The primary outcome of the study was the time measured from baseline to complete absorption of subretinal fluid during follow-up. Secondary outcome measures included serial changes in the logarithm of the minimum angle of resolution (logMAR) visual acuity and OCT. Statistical analyses were performed using a commercially available statistical software package (SPSS).

**RESULTS:**

Fifteen eyes of 15 patients (10 men, 5 women) with CSC were treated with intravitreal bevacizumab injection. Their age at the time of treatment ranged from 32 to 55 years (mean 43.4). Pretreatment visual acuity ranged from 20/25 to 20/100. All patients had recent exacerbation of visual changes before receiving treatment and none of them had received other treatments before. All patients had one or more focal RPE leaks responsible for the neurosensory detachment, and these serous detachments of the central macula were confirmed by OCT. All patients had complete or nearly complete anatomic resolution of macular fluid and had improvement in visual acuity within 1 month after treatment. Mean pretreatment LogMAR visual acuity was 0.32 and improved to 0.04 at 6 months' follow-up, which was statistically significant. No patient lost vision or suffered from any significant complications related to the treatment Table 1.

**DISCUSSION:**

Typical acute CSCR is characterized by duration of symptoms and/or retinal detachment of less than 6 months and monofocal or multifocal fluorescein angiographic retinal pigment epithelium leakage. The treatment of CSCR is based largely on observation. The high spontaneous remission rate favors conservative management, lifestyle counseling, and discontinuation of glucocorticoid medication as first-line therapeutic options. But there is some evidence supporting the benefit of early treatment for CSCR. A potential benefit for early resolution may be mediated by a lower rate of RPE degeneration in the treated eye, which is also warranted because of an uncertain relation between the onset of detachment and that of symptoms and special occupational demands for binocular visual function. Although there is no definite evidence about early treatment for CSC, many retinal specialists tend to consider laser photocoagulation, PDT with verteporfin and some medical treatment as early treatment.

### Table 1

<table>
<thead>
<tr>
<th>S. No</th>
<th>Age</th>
<th>Gender</th>
<th>Eye</th>
<th>Episode duration before treatment</th>
<th>VA before treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>47</td>
<td>M</td>
<td>Right</td>
<td>1 month</td>
<td>20/40</td>
</tr>
<tr>
<td>2</td>
<td>52</td>
<td>M</td>
<td>Left</td>
<td>2 weeks</td>
<td>20/30</td>
</tr>
<tr>
<td>3</td>
<td>54</td>
<td>F</td>
<td>Right</td>
<td>2 months</td>
<td>20/60</td>
</tr>
<tr>
<td>4</td>
<td>45</td>
<td>M</td>
<td>Right</td>
<td>3 weeks</td>
<td>20/30</td>
</tr>
<tr>
<td>5</td>
<td>35</td>
<td>F</td>
<td>Right</td>
<td>2 months</td>
<td>20/25</td>
</tr>
<tr>
<td>6</td>
<td>42</td>
<td>F</td>
<td>Left</td>
<td>1 month</td>
<td>20/100</td>
</tr>
<tr>
<td>7</td>
<td>37</td>
<td>M</td>
<td>Right</td>
<td>1 month</td>
<td>20/50</td>
</tr>
<tr>
<td>8</td>
<td>42</td>
<td>M</td>
<td>Left</td>
<td>1 month</td>
<td>20/40</td>
</tr>
<tr>
<td>9</td>
<td>46</td>
<td>M</td>
<td>Left</td>
<td>2 months</td>
<td>20/100</td>
</tr>
<tr>
<td>10</td>
<td>43</td>
<td>M</td>
<td>Left</td>
<td>1 month</td>
<td>20/25</td>
</tr>
<tr>
<td>11</td>
<td>40</td>
<td>F</td>
<td>Right</td>
<td>1 month</td>
<td>20/50</td>
</tr>
<tr>
<td>12</td>
<td>37</td>
<td>M</td>
<td>Right</td>
<td>1 month</td>
<td>20/40</td>
</tr>
<tr>
<td>13</td>
<td>51</td>
<td>M</td>
<td>Right</td>
<td>4 months</td>
<td>20/30</td>
</tr>
<tr>
<td>14</td>
<td>48</td>
<td>F</td>
<td>Left</td>
<td>2 months</td>
<td>20/40</td>
</tr>
<tr>
<td>15</td>
<td>32</td>
<td>M</td>
<td>Right</td>
<td>1 week</td>
<td>20/40</td>
</tr>
</tbody>
</table>
Laser photocoagulation and PDT with verteporfin accelerate the resolution of detachment,\textsuperscript{13-20} but they should be used with caution because they can induce permanent damage to the RPE or choriocapillaris, severe injury to retina, subretinal choroidal neovascularization, often many years after the primary incident.\textsuperscript{21,22}

One experimental study showed that PDT with verteporfin resulted in morphologic and functional breakdown of the outer blood-retinal barrier and function of RPE or RPE cells themselves with increasing concentration of verteporfin.\textsuperscript{23}

Vascular endothelial growth factor has profound effects on vascular permeability. Bevacizumab is a full-length antibody that binds all isoforms of VEGF. A growing number of reports in the literature support its safety and efficacy in many disorders. The mechanism by which intravitreal bevacizumab therapy ameliorates RPE leak and resorption of subretinal fluid in CSCR is unknown. But indocyanine green angiography in patients with CSCR has demonstrated evidence of choroidal lobular ischemia, choroidal venous congestion\textsuperscript{24-26} and also multiple areas of choroidal vascular hyperpermeability, suggesting a more generalized RPE or choroidal vascular disturbance.\textsuperscript{27-33}

Choroidal ischemia in CSC may induce an increase in the concentration of VEGF. The reduction of VEGF concentration may have the desired effect in patients with CSCR, with breaking the chain of events leading to neurosensory detachment.

In this small case series, we demonstrated that intravitreal bevacizumab injection in patients with CSCR can bring on rapid resorption of subretinal fluid, which can be associated with rapidly improved vision. This result provided the basis for the current study and prompted further exploration of the treatment.

Although this case series demonstrated successful treatment of acute CSCR and none of the patients experienced a significant adverse event with intravitreal bevacizumab injection, it is limited by small number of patients and short follow-up. Furthermore, individuals with CSCR may experience spontaneous resolution of their symptoms and leakage; our lack of a control group also does not allow one to determine if the resolution of the serous detachment and RPE leaks in our cases was actually a result of treatment or was due to the natural resolution of the disease. But the temporal course suggests that the improvement is likely due to the intravitreal bevacizumab injection. These results are promising. We also need to make further investigations into the possible role of VEGF in the pathogenesis of CSCR and treatment of CSCR with anti-VEGF agents to understand more precisely the risk and benefit of the therapy for patients with CSCR.

CONCLUSION:

Intravitreal bevacizumab injection for acute central serous chorioretinopathy may result in prompt resolution of neurosensory detachment and reduction of angiographic leakage. These short-term results suggest that intravitreal bevacizumab injection may constitute a promising therapeutic option in acute central serous chorioretinopathy.

REFERENCES:

63.

Role of Intravitreal Bevacizumab in the Treatment of Acute Central Serous Chorio- retinopathy
Comparison of Frequency of Recurrence after Surgery for Primary Pterygium using free Conjunctival Autograft Transplantation & Bare Scleral Technique

Saber Mohammad, FCPS¹, Sanaullah Khan, FCPS², Hussain Ahmad, MBBS³, Zaman Shah, FCPS⁴

ABSTRACT:

Purpose: The main objective of this study was to compare the frequency of recurrence of Pterygium after surgery with free conjunctival autograft transplantation and bare scleral technique.

Materials and Methods: All patients were admitted to the Eye “A” unit of KTH Peshawar. They were all having primary Pterygium. Patients were selected on the basis of inclusion and exclusion criteria and details were recorded on pre developed proforma. We divided patients into two groups. Group A and group B. Equal number of patients (41) were included in each group randomly on the basis of lottery method. We applied bare sclera technique on group A and free conjunctival autograft on group B. All patients were operated under sub conjunctival anesthesia. Patients were followed at 1 week, 3 months & 6 months, and were examined for recurrence and any other complications. All surgeries were performed by one surgeon.

Results: Total number of patients were 82 (41 for each group), Fifty five (67%) were male and 27 (33%) were female. The age of the patients ranged from 20-50 years. Occupations wise 30 (36.6%) were farmers, 20 (24.4%) fell in labors, 15 (18.3%) were students, 11 (13.4%) housewives and 6 (7.3%) were teachers.

The mean age and Standard Deviation (SD) in Group A and Group B are 32.78±7.62 and 34.12±6.21 respectively. In our study right eye was involved in 60 cases (73.2%) and left eye in 22 patients (26.8%). In Group A, right eye involved in 26 (31.7%) cases while left eye involved in 15 (18.3%) cases. In Group B, right eye involved in 34 (41.5%) cases while left eye in 7 (8.5%) cases. Regarding the type of pterygium 51 (62.2%) were type II, and 31 (37.8%) patient presented were in type III. 39.02% recurrence was noted in group A and 12.9% recurrence was noted in group B. P value is 0.0054 highly significant.

Conclusion: It is concluded that free conjunctival autograft transplantation is the better technique, for prevention of recurrence after Pterygium surgery. It is associated with low recurrence rate, minimal complications and cosmetically acceptable as compared to the bare sclera technique. However, this technique is not recommended in eye with scarred conjunctiva or if the conjunctiva has to be preserved for future glaucoma filtering surgery.

Key Words: Pterygium, conjunctival autograft transplantation (CAT), bare sclera technique (BST)

INTRODUCTION

Pterygium is a fibrovascular growth of degenerative bulbar conjuctiva over the limbus onto the cornea.¹ It is mostly on nasal side and is more frequent in areas with more ultraviolet radiation in hot, dry, windy, dusty and smoky environments.² Ultraviolet radiations A and B are most important in its pathogenesis³ It has got a broad base on nasal (more common) or temporal epibulbar surface and an apex on the cornea. A gray zone precedes the apex or head and is generally known as the “cap”. The cap is a flat, grayish white avascular zone located in the subepithelial corneal tissue, surrounding the head of the pterygium like a halo⁴.

In some cases of pterygium, a golden yellow iron line “the Stocker’s line” is seen in the corneal epithelium adjacent to the head.⁴ The head is an elevated structure which is firmly attached to the globe; whereas body of pterygium can be easily lifted from the epibulbar surface. The body is a fleshy, highly vascularized tissue that is delineated from normal conjunctiva both superiorly and inferiorly by sharp folds. The epithelial surface of the body and cornea immediately in front of the head may show punctate staining. Corneal dellen formation may occur in association with pterygia.⁵

The growth of pterygium across the cornea is a slow process and it usually takes several years to reach the visual axis. Progressive pterygium is characterized by a fleshy and congested appearance, whereas regression or inactivation is characterized by the
absence of episodic congestion, disappearance of punctate staining over the body and shrinkage of the cap. The lesion may remain stationary for several years and finally involution occurs. The head gets flattened and thinned out leaving behind a scar that blends with adjacent cornea and the body gets changed into a membrane-like structure with few fine blood vessels. Its incidence varies across geographical locations. Pterygium is a common disease in tropical and subtropical countries including Pakistan. Pterygium has three types. Type I, which extends less than 2mm onto the cornea. The lesion is often asymptomatic. Type II, which involves up to 4mm of cornea and may be primary or recurrent following surgery. It may interfere with precornal tear film and induce astigmatism. Type III, invade more than 4mm of cornea and involve visual axis. The clinical features include chronic irritation, conjunctivitis, reduced vision and cosmetic concern. The indications for surgery include:

1. Reduced vision due to direct involvement of the visual axis or due to astigmatism,
2. Chronic irritation,
3. Recurrent inflammation,
4. Restriction of ocular motility, and
5. Cosmesis.

To prevent recurrence, several adjunctive therapies, including the use of beta irradiation and Mitomycin C, have been recommended due to their anti-fibrotic and anti-angiogenic properties but they have serious side effects. There are several techniques used for pterygium surgery. The simplest one is bare scleral technique but it has high recurrence frequency i.e. 38.09%. Amniotic membrane and buccal mucosal grafts are also used for the treatment of pterygium but they are time consuming procedures and needs surgically skilled hands. The procedure which gained popularity in recent years for pterygium is free conjunctival autograft transplantation. It is simple, safe and highly effective with low recurrence i.e. 13.3%. In this procedure ipsilateral bulbar conjunctiva from superotemporal quadrant is removed and free grafted onto episcleral bed of excised pterygium. Differences in study methodology, patient characteristics, nature of pterygium, geographic area, definition of recurrence and duration of follow-up are some of the factors responsible for difference in the recurrence frequencies.

As the pterygium is very common in our country and the surgery is demanding, we decided to gain information about the frequency of recurrence of pterygium after excision with bare sclera technique as compared to free conjunctival autograft.

**MATERIAL AND METHODS**

This study was conducted from December 2010 to September 2011 at the Department of Ophthalmology, Khyber Teaching Hospital Peshawar. A total of 82 patients meeting eligibility criteria with primary Pterygium were enrolled. After enrollment complete ocular examination was done. Before their allocation into groups, the procedure was fully explained to the patients informing them that they could be allocated into either of the two groups. An informed consent was obtained from them for the surgery.

We divided patients into two groups. Group A and group B. Equal number of patients 41 were included in each group randomly on the basis of lottery method. We applied bare sclera technique on group A and free conjunctival autograft on group B. Fifty five were male and 27 were female. Patients’ age ranged from 20-50 years in each group.

All variables were noted from all patients and entered into typed proforma. All the procedures were performed in eye department Operation theatre under operating microscope by the same surgeon. The ocular surface was anesthetized with topical instillation of proparacaine hydrochloride 0.5% in combination with an additional subconjunctival injection in the bed of Pterygium with 0.5ml of 2% lidocaine hydrochloride with 0.001% adrenaline in all patients and 0.5ml at the donor site in free conjunctival autograft. First head of pterygium was excised from the cornea with Bard Parker No 15. blade and then cut it with scissor 2-3mm away from the limbus. Then cornea was shaved.

In free conjunctival autograft, bare sclera was measured with caliper. Haemostasis was achieved. The globe was rotated downward using stay sutures to expose the superotemporal bulbar conjunctiva. The measured dimensions were marked on exposed conjunctiva. Saline solution was injected under conjunctiva to facilitate the sole dissection of conjunctiva. Dissection began from fornix to limbus. The graft was flipped over onto the cornea and tenon’s attachment at limbus was meticulously dissected. The flap was then excised and moved onto the bare sclera and stitched with 8/0 virgin silk to the conjunctiva.

Post operatively topical corticosteroid- antibiotic ointment was used and a pressure patch applied for 24 hours. Antibiotic-steroid drops were administered 4 times a day and tapered during the following 2-3 months. After 1 week, follow up was done. Recurrence and other complications were noted. Patients were advised for next visit after three months and then after six months from the date of surgery. Data was analyzes on SPSS version 11.

**RESULTS**

We analyzed the data for 82 patients. Fifty five (67%) were male and 27(33%) were female. The age of the patients ranged from 20-50 years. Patients were equally divided into two groups, group A and group
B. Shown in table II.

In group A, patients underwent pterygium excision with bare sclera technique while in group B, pterygium excision with free conjunctival autograft transplantation.

Patients' data was analyzed for the main parameters of the study such as age, sex, frequency of recurrence and occupation. The quantitative variable, age was analyzed for mean and standard deviation and we found that mean age was 33.45 and SD is ±6.94. The mean age and SD in Group A and Group B are, 32.78±7.62 and 34.12±6.21 respectively. It is shown in table I. Regarding the Type of pterygium 51 (62.2%) were type II, and 31 (37.8%) patient presented were in type III. Twenty nine (35.4%) patients in group A, who underwent bare sclera technique and 22 (26.8%) in group B, who had free conjunctival autograft presented as type-II pterygium. Ten (34.5%) patients had recurrence in group A while no patient had recurrence in group B. P-Value is 0.0021 which is statistically very significant.

In patients with type III pterygium, out of 31 patients 12 (14.6%) were in group A while 19 (23.2%) were in group B. Recurrence occurred in 6 (50%) patient in group A and 5 case (26.3%) in group B. (P-Value = 0.1795, which is not statistically significant). The results are shown in table no III. In our study right eye was involved in 60 cases (73.2%) and left eye in 22 patients (26.8%). In Group A, right eye involved in 26 (31.7%) cases while left eye involved in 15 (18.3%) cases. In Group B, right eye involved in 34 (41.5%) cases while left eye in 7 (8.5%) cases. In our study age range in 55 male patients was 20 to 50 years. Out of ten patients in group A with age rang 20-30 years 3 (30%) had recurrence while in group B, 1 case (12.5%) out of 8 (P Value=0.3749). Age class of 31 to 40 years, out of 12 patients 5 (41.66%) had recurrence in group A while in group B, 2 (16.66%) out of 12 had recurrence (P value= 0.1779). In age range 41-50 years male patient in group A, 2 (40%) out of 5 had recurrence, while 1(12.5%) out of 8 patients in group B suffered recurrence (P value=0.2522).

There were 27 female patients. In group A, 1 (25%) patient out of 4 had recurrence while no patient suffered recurrence in group B in age group 20-30 years female (P-Value = 0.4386). In 31-40 years, 4 (50%) out of 8 had recurrence in group A while 1 (10%) out of 10 patients suffered recurrence in group B (P-value = 0.0597). In 41-50 years, 1 (50%) out of 2 patients in group A had recurrence while no such recurrence in group B occurred. (P-Value = 0.3865).

Occupations wise 30 (36.6%) were farmers, 20 (24.4%) fell in labors, 15 (18.3%) were students, 11 (13.4%) housewives and 6 (7.3%) were teachers. 18 (22%) were in group A and 12 (14.6%) were in group B in farmer group. In this group recurrence frequency was 8 (44.4%) out of 18 patients in group A while it was 2 (16.7%) out of 12 patients in group B. The P-Value is 0.1138 which is not statistically significant. In 20 laborers, 12 (14.6%) were in group A and 8 (9.8%) were in group B who underwent bare sclera technique and free conjunctival autograft technique respectively. The recurrence frequency in laborers was 5 (41.7%) in group A and 3 (37.5%) in group B. P-Value is 0.8522 which is statistically insignificant. Similarly in 15 students, 4 (4.9%) were in group A while 11(13.4%) were in group B. The recurrence frequency in group A was 2(50%) while there was no recurrence in group B. P-Value is 0.0118 which is statistically significant.

Six patients were teachers, 2(2.4%) in group A and 4(4.9%) in group B. Recurrence occurred only in group A which was 1(50%) patient. P-Value is 0.1213 which is

<table>
<thead>
<tr>
<th>TABLE I (a)</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
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</thead>
<tbody>
<tr>
<td>Age of patients</td>
<td>82</td>
<td>20</td>
<td>47</td>
<td>33.45</td>
<td>6.94</td>
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<tr>
<td>Group A</td>
<td>41</td>
<td>20</td>
<td>47</td>
<td>32.78</td>
<td>7.62</td>
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<tr>
<td>Group B</td>
<td>41</td>
<td>21</td>
<td>46</td>
<td>34.12</td>
<td>6.21</td>
</tr>
</tbody>
</table>

<p>| TABLE NO. I (b) |
|-----------------|-----------------|-----------------|-----------------|</p>
<table>
<thead>
<tr>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
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</thead>
<tbody>
<tr>
<td>Age of patients</td>
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<td>20</td>
<td>47</td>
<td>33.45</td>
</tr>
<tr>
<td>Group A</td>
<td>41</td>
<td>20</td>
<td>47</td>
<td>32.78</td>
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<tr>
<td>Group B</td>
<td>41</td>
<td>21</td>
<td>46</td>
<td>34.12</td>
</tr>
</tbody>
</table>
not statistically significant.

As compare to laborers, farmers, students and teachers, house wives had no recurrence for any surgical techniques. All these results are shown in table IV. Two separate surgical techniques were performed for group A & B. In group A, where bare sclera technique was applied recurrence was in 16 patients (39.02%). In groups B where free conjunctival autograft was done, recurrence was noted in 5 cases (12.2%). P value calculated by chi-square test (7.746), is 0.0054, which is highly statistically significant showing high recurrence frequency in Group A. It is shown in table V.

**DISCUSSION**

Pterygium is one of the most common disorders in tropical and subtropical regions including Pakistan. The most important risk factor is exposure to sunlight. It affects the visual acuity either by directly affecting the visual axis or by producing changes in the corneal curvature.

In our study maximum number of patients were farmers 30 (36.6%) and laborers 20 (24.4%), who had to work outside for long periods of time and were exposed to hazardous effects of the infrared and ultraviolet radiations present in the sunlight.

In this study there was significant association between pterygium and UV-rays. According to Khoo – Jet al, there was high association between the outdoor work and pterygium which may be related to high exposure to sunlight and dust. The same idea was supported by Wilder et al and Threfall –TJ. McCarty CA also documented that pterygium was a significant public health problem in rural areas primarily as a result of ocular sun exposure.

There are multiple surgical techniques to treat pterygium but recurrence is common. Adjunctive treatment after bare sclera excision with β-irradiation reduced recurrence frequency to as low as 0.5%-16%, but was associated with significant complications like scleral necrosis. The use of Mitomycin C was also associated with complications such as secondary glaucoma, corneal edema, iritis, corneal perforation, endophthalmitis and cataract. We performed pterygium excision with two different techniques and compared the results. Bare sclera technique is easiest method but recurrence frequency ranging from 30-82% and associated with high rate of complications. In our study recurrence frequency after this technique was 39.02%. Conjunctival autograft is a time consuming procedure and need surgical skill, recurrence frequency reported from 0-13.3% and less complications. In our study frequency was 12.9%. This study showed that free conjunctival autograft was superior to bare sclera technique, P-Value=0.0054 which is highly statistically significant.

### TABLE NO. III

<table>
<thead>
<tr>
<th>S.No</th>
<th>Type of Pterygium</th>
<th>Group A Recurrence</th>
<th>Group B Recurrence</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Type-II</td>
<td>29 (35.4%) 10(34.5%)</td>
<td>22(26.8%) Nil</td>
<td>0.0021*</td>
</tr>
<tr>
<td>2</td>
<td>Type-III</td>
<td>12 (14.6%) 6 (50%)</td>
<td>19 (23.2%) 5 (26.3%)</td>
<td>0.1795</td>
</tr>
</tbody>
</table>

*Statistically significant
Group A = Bare sclera technique (BST)
Group B = Free conjunctival autograft (FCA)

### TABLE NO. IV

<table>
<thead>
<tr>
<th>S.No</th>
<th>Occupation</th>
<th>Group A Recurrence</th>
<th>Group B Recurrence</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Farmers</td>
<td>18 (22%) 8 (44.4%)</td>
<td>12 (14.6) 2 (16.7%)</td>
<td>0.1138</td>
</tr>
<tr>
<td>2</td>
<td>Laborers</td>
<td>12 (14.6%) 5 (41.7%)</td>
<td>8 (9.8%) 3 (37.5%)</td>
<td>0.8522</td>
</tr>
<tr>
<td>3</td>
<td>Students</td>
<td>4 (4.9%) 2 (50%)</td>
<td>11 (13.4) Nil</td>
<td>0.0118</td>
</tr>
<tr>
<td>4</td>
<td>Housewives</td>
<td>5 (6.1%) Nil</td>
<td>6 (7.3%) Nil</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Teachers</td>
<td>2 (2.4%) 1 (50%)</td>
<td>4 (4.9%) Nil</td>
<td>0.1213</td>
</tr>
</tbody>
</table>

Group A = Bare sclera technique
Group B = Free conjunctival autograft
TABLE NO.V
Recurrence of pterygium in bare sclera technique and free conjunctival autograft

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Surgical procedure</th>
<th>Total no of patients</th>
<th>No of recurrence</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bare sclera technique</td>
<td>41</td>
<td>16</td>
<td>39.02%</td>
</tr>
<tr>
<td>2</td>
<td>Free conjunctival autograft</td>
<td>41</td>
<td>5</td>
<td>12.9%</td>
</tr>
</tbody>
</table>

Chi-square test = 7.746
P-Value = 0.0054 (Highly statistically significant)

The result of bare sclera technique was favored by Ashaye who gave 40% recurrence frequency. Another study done by Dash and Bapori who observed 25% recurrence frequency. Stark et al reported 30-70% and Singh et al showed 73% recurrence frequency.

These variations may be due to occupation of the patient, morphology of pterygium and number of patients studied. There are few complications which can occur with bare scleral technique like scleral necrosis, conjunctival cyst formation, symblepharon and tenon granuloma. The cause being abnormal exposure of tenon tissues without adequate cover by conjunctival tissue or the incarceration of tenon in the conjunctival wound. Cameron also noted these complications. Conjunctival autograft is cosmetically acceptable technique and related to no recurrence or low recurrence frequency.

This is due to transplantation of normal conjunctiva that forms barrier to the proliferation and advancement of residual abnormal tissues towards the limbus. The recurrence frequency has been reported from 0-13.3%. A study by Hille K et al noted recurrence frequency of 12.2% after pterygium excision with free conjunctival autograft. These results are similar to our study (12.9%). Other study done by Kenyon et al noted recurrence frequency 5.3% after pterygium excision with conjunctival autograft. Study conducted by Figueriredo et al observed a low recurrence after pterygium excision with Free Conjunctival Autograft (They did not define low recurrence). Study by Frau on the treatment of pterygium with free conjunctival autograft noted no recurrence. While Chaidaroon noted 5% of recurrence of pterygium treated with free conjunctival autograft. Study done by Kmiha et al, noted 10% recurrence frequency. Mejia noted 1.8% recurrence frequency with free conjunctival autograft. Tan & De Keizer noted 2% and 6.6% recurrence frequency after free conjunctival autograft. Recently, Prabhasawat et al used amniotic membrane graft as an alternative to conjunctival autograft but with recurrence of 10.9% for primary pterygium and 37.5% for recurrent pterygium as compared to 2.6% and 9.1% of conjunctival autograft. These variations may be due to sample size and geographic variations.

No intraoperative complications were noted in our study. Post operative complications can occur like, graft edema and hemorrhage, graft retraction, subtenon granuloma in the superotemporal region. Conjunctival autograft have successful results and are widely accepted in the management of pterygium. However this technique cannot be used in eyes in which conjunctiva is already scarred from previous surgery or if the conjunctiva has to preserved for future glaucoma filtering surgery. In our study the free conjunctival autograft technique was found superior to bare sclera technique as the recurrence frequency was statistically low (12.9% vs 39.02% P-Value = 0.0054). In conclusion, this is safe technique, have low recurrence and cosmetically acceptable.

CONCLUSION

It is concluded that free conjunctival autograft transplantation is more effective associated with less complication then bare sclera technique (P-value=0.0054). All pterygium excision should be done with free conjunctival autograft transplantation.

REFERENCES

Comparison of Frequency of Recurrence after Surgery for Primary Pterygium

INTRODUCTION

Visual impairment is a global health problem.¹ It is estimated that 37 million of the world population is blind and 124 million have severe visual impairment.¹ According to previous studies cataract is responsible for 50% of blindness worldwide.² The treatment of cataract available today has passed through evolution.³ Of the long term complications of cataract surgery, posterior capsule opacification (PCO) is the most common⁴. The incidence of PCO varies from 10% - 50% when followed for 2 years postoperatively⁵. PCO formation is a manifestation of proliferation of equatorial epithelial cells across the posterior capsule.⁶ It causes reduction in visual acuity (VA) and contrast sensitivity by obstructing the view or by scattering the light that is perceived by patients as glare.⁷⁻⁸⁻⁹. It also decreases the field of view during therapeutic and diagnostic procedures.¹⁰

Before the Neodymium- Yttrium- Aluminum- Garnet (Nd: YAG) laser came into use, the treatment of PCO was surgical capsulotomy, which is not free from drastic complications such as endophthalmitis. Today PCO is treated with Nd: YAG laser, which is safer, more effective and an out-patient procedure. The decreased rate of complications and faster recovery has made Nd: YAG laser capsulotomy a popular approach for the treatment of PCO.¹¹

Nd: YAG Laser is a photo disruptive laser which produces extreme heat of about 10,000 C° along with an acoustic shock wave at the site being focused and thus causes disruption of tissues. This property of Nd: YAG Laser is used to disrupt the posterior lens capsule in order to create an opening in it¹². This causes significant improvement in visual acuity (mean decimal visual acuity 0.49±0.14 SD before and 0.6±0.19 SD after Nd: YAG laser posterior capsulotomy).¹³

Nd: YAG Laser posterior capsulotomy is frequently performed in our hospital but no study has been undertaken on the subject in the recent past. This study has been designed to determine improvement in VA by Nd: YAG laser capsulotomy in patients with PCO.

MATERIAL AND METHODS.

This study was conducted at out-patient department, Ophthalmology Unit, KIOMS, PGMI, LRH Peshawar. Prior to the start, permission from hospital ethical committee was obtained. Patients were included in the study after fulfilling inclusion and diagnostic criteria that included: a) Posterior capsular opacification seen on slit lamp examination b) Visual acuity between 6/24 to 6/60 seen on Snellen’s VA chart. The patients were evaluated for inclusion and exclusion criteria. A special data collection proforma was filled for each
patient and had a detailed record of the disease including name, age, gender, address etc.

After enrollment in the study, detailed history, visual acuity (VA) using standard Snellen’s visual acuity chart, slit lamp examination, IOP by Goldmann applanation tonometer, direct and indirect ophthalmoscopy, and B-scan ultrasonography in cases of dense PCO, was carried out by same senior surgeon before YAG laser capsulotomy to avoid any biased study.

Patients were dilated and properly prepared prior to the procedure. Proper instructions were given to the patients before the procedure. 3-4 mm of capsulotomy was done by same senior surgeon using same laser machine, if clinically indicated.

Confounders and bias were controlled by strictly following exclusion and by proper follow up. Patients were instructed to come for follow up after one week. On follow up visual acuity was checked using standard snellen’s visual acuity chart. The data was recorded in a proper proforma. All the analysis was done in SPSS 10.1. Frequency and percentage were calculated for categorical variables like gender, improvement in visual acuity. Mean + standard deviation was computed for numerical variables like age, and pre procedure V.A. All the results were presented in the form of graphs and tables.

**Inclusion Criteria:**
1) All patients whether male or female, from 10 to 60 years of age having PCO and visual acuity between 6/24 and 6/60 on Snellen’s VA chart.
2) Pseudophakic patients of more than 6 months duration of cataract surgery with posterior chamber intraocular lens.

**Exclusion Criteria:**
1) Infants, children less than 10 years of age and very old patients who are unable to cooperate because it is not possible to perform Nd:yag laser capsulotomy on them.
2) Patients with ocular complications like endophthalmitis dislocated IOL, IOL in traumatic cataract because these complications will further reduce visual acuity.

**RESULTS**
This study was conducted at Khyber Institute of Ophthalmic Medical Sciences (KIOMS), Lady Reading Hospital, Peshawar in which 251 patients were observed and the results were analyzed.

Age distribution among 251 patients were analyzed as n=15(6%) patients were in age ranged 10-20 years n=40(16%), 21-30 years n=53(21%), 31-40 years n=65(26%), 41-50 years n=78(31%) and 51-60 years. Mean age was 54 years with standard deviation±13.51. Minimum age was 31 years while maximum age was 80 years. Gender distribution among 251 patients were analyzed as n=161(64%) patients were males while n=90(34%) were females. There were n=141(56%) patients had posterior lens capsule opacification in the right eye while n=110(44%) patients had posterior lens capsule opacification in the left eye after extracapsular cataract extraction and phacoemulsification with posterior chamber intraocular lens implantation.

The pre-procedure assessment of distant visual acuity of the patients was 6/12 in n=30(12%) patients, 6/18 in n=33(13%) patients, 6/24 in n=55(22%) patients, 6/36 in n=88(35%) patients and 6/60 in n=45(18%) patients. (as shown in Table No 1)

The post-treatment distant visual acuity of the patients was 6/06 in n=30(12%) patients, 6/09 in n=38(15%) patients, 6/12 in n=85(34%) patients, 6/18 in n=82(33%) patients, 6/24 in n=8(3%) patients and 6/36 in n=8(3%) patients. (as shown in Table No 2)

The mean decimal pre-treatment visual acuity was 0.2307±0.1235. The mean decimal post-treatment visual acuity was 0.5121±0.2231. Difference between pre and post treatment decimal visual acuity by applying paired sample t-test was significant. (P-value = 0.000). Thus hypothesis is proved that visual acuity improved after Nd: YAG laser capsulotomy in patients with extracapsular cataract extraction and phacoemulsification with posterior chamber intraocular lens implantation.

Frequency of improvement is also very higher as n=228(91%) of patients showed improvement of minimum of two line positive change on Snellen’s distant acuity scoring system while only n=23(9%) patients did not show any improvement. (as shown in Table No 3)

The pre and post treatment visual acuity was compared using paired T-test which shows significant difference in visual acuity with p-value=0.000.

**DISCUSSION**
There were 251 patients involved in the study with mean age range of 54.78±13.51 years. The mean age of such patients in one study done in Manchester Eye Hospital, UK was 75.2 years. While in another study

**TABLE NO 1:**

<table>
<thead>
<tr>
<th>Pre-procedure Distant Visual Acuity</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/12</td>
<td>30</td>
<td>12%</td>
</tr>
<tr>
<td>6/18</td>
<td>33</td>
<td>13%</td>
</tr>
<tr>
<td>6/24</td>
<td>55</td>
<td>22%</td>
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<tr>
<td>6/36</td>
<td>88</td>
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<tr>
<td>6/60</td>
<td>45</td>
<td>18%</td>
</tr>
<tr>
<td>Total</td>
<td>251</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
the mean age range was 65.08±10.47. This is because all patients had age-related cataract which was operated and they developed PCO.

Out of total 251 patients, 160(63.3%) were male and 91 (36.7%) were female in our study. There were 14 (53.8%) females and 12 (46.2%) males in a study done in UK. There were 19 (55.9%) male and 15 (44.1%) females in study done in Greece. And 46% male and 54% females in study done in Eye Hospital Hyderabad.

According to our study, the mean duration between the cataract surgery and Nd: YAG laser treatment was found to be 3.138±1.282 years. In another study it was found to be 10 months to 15 months. The study of 500 cases, the average time from cataract surgery to Nd: YAG laser capsulotomy was 2.06 years, the minimum 3 months and the maximum more than 4 years. The majority of patients (46%) had PCO between 3 months to 12 months post-operatively. Apple DJ has noted the incidence of PCO up to 50% by two years postoperatively, while other authors have reported the incidence of PCO up to 43% in five years duration after extra capsular cataract extraction and in study of 369 eyes noted the frequency of PCO in 1.6%, 12.3% and 26.5% after cataract surgery in the duration of 1, 2 and 3 years respectively.

There were 141(56%) patients had posterior lens capsule opacification in the right eye while 110(44%) patients had posterior lens capsule opacification in the left eye after extracapsular cataract extraction and phacoemulsification with posterior chamber intraocular lens implantation.

The pre-treatment distant visual acuity of the patients was 6/12 in 30(12%) patients, 6/18 in 33(13%) patients, 6/24 in 55 (22%) patients, 6/36 in 88(35%) patients and 6/60 in 45(18%) patients. While in a study of Greece, 2.9% patients had VA 20/32 and 20/60, 20.6% had VA 20/40, 14.7% had 20/50 and 20/60, 17.6% had VA 20/80 and 26.6% had VA 20/100. While in study of Hyderabad, 80.4% of patients had pre-Laser VA >20/30, among them 52.4% had VA above 6/60.

According to our study the post-treatment distant visual acuity of the patients was 6/6 in 30 (12%) patients, 6/9 in 38 (15%) patients, 6/12 in 85 (34%) patients, 6/18 in 82 (33%) patients, 6/24 in 8 (3%) patients and 6/36 in 8 (3%) patients. The study of Greece showed that out of 34 patients only 1 (2.9%) patient had post treatment VA 20/80 while other patients (85.3%) recover well and had VA less than 20/60 and concluded that Nd:YAG capsulotomy seems to be a safe and effective procedure for eyes that have previously undergone combined phacoemulsification and vitrectomy surgery. The study of Hyderabad showed that there were no patients that had VA 6/6-6/12 pre-treatment but after treatment there were 372 (74.4%) had VA 6/6-6/12.

In our study the mean decimal pre-treatment visual acuity was 0.2307±0.1235 and mean decimal post-treatment visual acuity was 0.5121±0.2231. Difference between pre and post treatment decimal visual acuity by applying paired sample t-test was significant. Thus hypothesis is proved that visual acuity improved after Nd: YAG laser capsulotomy in patients with extracapsular cataract extraction and phacoemulsification with posterior chamber intraocular lens implantation.

Frequency of improvement is also very high. 228 (91%) of patients showed improvement of minimum of two line positive change on Snellen’s distant acuity scoring system while only 23 (9%) patients did not show any improvement in our study. Similar results were seen in study done in Hyderabad. Researchers found 93.9% had improved visual acuity (more than 2 line improvement in Snellen’s lines).

CONCLUSION

Thus it is concluded that visual acuity in patients who develop secondary posterior lens capsule opacification after cataract extraction with intraocular lens implantation is better after Neodymium: YAG Laser posterior capsulotomy than the visual acuity before the use of Neodymium: YAG Laser, (p-value < 0.05).

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Efficacy of Excimer Laser Photorefractive Keratectomy in High Myopia

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Pakistan Institute of Ophthalmology, Al-Shifa Trust Eye Hospital, Rawalpindi

ABSTRACT:
Objective: To assess the efficacy and safety of excimer laser photorefractive keratectomy in high myopic Pakistani population.
Study Design: It is a prospective interventional study conducted during August, 1995 to August 1996.
Participants and Methods: Forty-nine (49) operated eyes were enrolled in this study with a refractive error ranged from -6.25 to -20.00 diopters. Range of the astigmatism was from -0.50 to -4.0 diopters giving an average of 0.93. Six (12.24%) eyes did not turn up for final visit and 43 (87.76%) eyes were followed till last visit six months after photorefractive keratectomy.
Results: At 1 month, 3 months and 6 months after PRK, 14.28%, 20.40% and 20.97% eyes respectively achieved 6/6 visual acuity without glasses. At six months postoperatively 10 (23.25%) eyes were hypermetropic, 10 eyes (23.25%) were myopic between 1 to 4 diopters spherical equivalent, 4 (09.30%) eyes had spherical equivalent refraction between -6.00 to -8.25 diopters, 10 (23.25%) eyes presented with astigmatism more than +1.0 DC and 11 (25.58 %) eyes with more than -1.0 DC at the end of six months. All the 43 eyes presented with various degree of corneal haze at six months follow up visit. No serious complication was reported.
Conclusion: The short term follow up revealed PRK to be less effective and predictable for the correction of high myopia mainly due to corneal haze and regression of effect.

INTRODUCTION:
Myopia can be corrected satisfactorily with spectacle and contact lenses but many people want clear vision without dependence on corrective optical devices1. Refractive surgery came as harbinger of happiness for these people. As the Argon Fluoride excimer laser found its use as cutting device it led to the development of photo refractive keratectomy (PRK). Excimer laser photorefractive surgery modifies the anterior corneal curvature by laser ablation of corneal tissue2. Since birth of PRK several countries worldwide have been evaluating 193nm argon fluoride excimer laser for myopia. Numerous studies have used the excimer laser to correct refractive error .Good results have been reported for low myopia and somewhat less predictable results for high myopia3. This study was carried out to assess/check the efficacy, safety and predictability of PRK for high myopia in our population.

PARTICIPANTS AND METHODS:
It was a prospective interventional study done at Al-Shifa Trust Eye Hospital Rawalpindi. Approval of the study was taken from the Hospitals Ethical committee. Only high myopic between -6.25 to -20 DS with a range of astigmatism between -0.50 to – 4 DC were evaluated in this study. Eligible candidates were at least 18 years of age with relatively stable myopia during the last one year. Patients suffering from any ocular or systemic disease were excluded .All patients gave written informed consent at the time of enrollment in the study. Contact lens wear was stopped at least one month before surgery. All patients had detailed slit lamp biomicroscopy. Unaided and best corrected visual acuity was recorded using snellen visual acuity chart. Meticulous refraction was done with auto refractor and retinoscope in each case without any cycloplegics. Applanation tonometery was done. Direct and indirect ophthalmoscopy was performed on each case and 90 Diopter lens was used, whenever required.

PRK was performed with Omni Med U.V 270300 excimer laser system, using an energy density of 180 mj/cm2 with a repetition rate of 10 Hz. (Summit technology (USA), approved by Food and Drug Administration (FDA) for therapeutic use. Local anesthesia was achieved with Alcaine (Proparacain 0.50%) or Novesin (Oxy buprocain hydrochloride (0.4%) eye drops. Chloramphenicol 0.50 % eye drops were used.
Efficacy of Excimer Laser Photorefractive Keratectomy in High Myopia

The study group comprised 49 eyes within range of -6.25 to -20.00 diopters refractive error. Range of astigmatism was -0.50 to -4.00 diopters with an average of 0.93. Six eyes (12.24%) did not turned up for final visit. 43 (87.76%) eyes were examined at final visit per schedule at six months postoperatively. 26 (54%) eyes completed epithelialization on 3rd postoperative day, 22 eyes (44%) on 4th postoperative day and one eye (02%) took the 7 days to complete the healing process. Moderate to severe postoperative pain was experienced by every one for three days, which gradually subsided as prophylactic antibiotic. Few drops of 2% Pilocarpine were instilled to constrict the pupil. The eye was kept open during laser delivery by wire speculum. Each patient was supposed to maintain self fixation throughout the procedure. 100% manifest refraction at the corneal plane was entered. Three zones were entered for each eye. 100% of the manifest refraction was entered in zone one (5.0 mm), 70% in zone two (6.00mm) and only 30% in zone three (6.50 mm). Epithelium of about 7 mm zone was removed mechanically with a Beaver blade 64. Methyl cellulose was used on weck sponge to smooth the corneal surface after epithelial removal. Surface was dried with weck sponge and then laser ablation was performed. Medication used included one drop of each, 2% Homatropine, 0.5% Chloramphenicol, Ocufen (Flurbiprofen Sodium 0.04 %) and Chloramphenicol eye ointment in each eye before applying occlusive bandage for 48 hours. Postoperative examinations were performed after 2nd day and 1,3and 6 months. Tobrex (Tobramycin 0.3%) and Maxidex (dexamethasone sodium phosphate 0.1 %) eye drops, four times a day were advised after epithelialization, to be replaced after two weeks by FML eye (Flouromethalone 0.1 %) drops four times a day.

**RESULTS:**

The study group comprised 49 eyes within range of -6.25 to -20.00 diopters refractive error. Range of astigmatism was -0.50 to -4.00 diopters with an average of 0.93. Six eyes (12.24%) did not turned up for final visit. 43 (87.76%) eyes were examined at final visit per schedule at six months postoperatively. 26 (54%) eyes completed epithelialization on 3rd postoperative day, 22 eyes (44%) on 4th postoperative day and one eye (02%) took the 7 days to complete the healing process. Moderate to severe postoperative pain was experienced by every one for three days, which gradually subsided with epithelial healing. Three patients presented with transient rise in IOP in their both eyes (12.24%) one month after PRK. IOP remained between 28 mm of Hg to 32 mm of Hg. Potent steroids (Maxidex) were replaced with mild steroids (FML eye drops). Two patients were given 0.5% Betagan eye drops two times a day and one was not given, IOP was controlled in all after one week. Detailed results of the study at one month, three months and six months follow up visits are as under:

**At one month:** One eye achieved (2.04 %) visual acuity between counting fingers (CF) and hand movements (HM). 05 eyes (10.20%) achieved 6/60, 06 eyes (12.24%) achieved 6/36, 09 eyes (18.36 %) achieved 6/24, 11 eyes (22.48%) achieved 6/18, 05 eyes (10.20%) achieved 6/12, another 05 eyes (10.20%) achieved 6/9 and 07 eyes (14.28%) achieved 6/6 visual acuity without any optical aid. (Table No. 1).

It was found that 03 eyes (6.12 %) could be corrected up to 6/60 , another 03 eyes (06.12 %) up to 6/36 , 06 eyes (12.24 %) up to 6/24 , 07 eyes(14.28%) up to 6/18, 06 eyes (12.24%) up to 6/12, 10 eyes (20.40%) up to 6/9 and 14 eyes (28.60%) up to 6/6. (Table No.2).

It was also observed that 08 eyes (16.32%) were overcorrected by +1 diopter spherical equivalent, 19 eyes (38.80%) ranged between +1.25 to +2.00 diopter spherical equivalent. Seven eyes (14.28%) were found within the range of +2.25 to +3.00 diopters spherical equivalent. One eye (2.4%) was overcorrected by +4.00 diopters spherical equivalent. Four eyes (08.16 %) ranged from +4.25 to +5.00 diopters spherical equivalent. Two eyes (4.08%) were with in range of +5.25 to +6.00 diopters spherical equivalent. Three eyes (06.12%) revealed under correction up to -1.00 diopter spherical equivalent and 02 eyes (4.08%) by -1.50 and -2.00 diopter spherical equivalent. Two eyes (4.08 %) had residual myopia of -2.50 -3.00 diopters spherical equivalent. Only one eye (2.4%) was emmetropic (Table No. 3). Twenty five eyes (51.02%) had astigmatism of more than +1.00 diopters. Only one eye (02.04%) had astigmatism more than -1.00 diopters. Eighteen eyes (36.75 %) scored grade 1 corneal haze, 23 eyes (46.93%) were given grade 2 corneal haze, and 03 eyes (6.12%) had grade 3 degree corneal haze at one month postoperatively. (Table No.4).

**At three months:** 6/60 visual acuity was recorded in 05 eyes (10.20%), 6/36 in 03 eyes (06.12%), 6/24 in 08 eyes (16.32%), 6/18 in 16 eyes (32.68%), 6/9 in 07 eyes(14.28%) and only 10 eyes (20.40%) reached to 6/6 without glasses at the end of three months follow up visit. (Table No.1). Two eyes (4.08%) achieved 6/60, 04 eyes (8.16%) 6/36, 14 eyes (28.59%) 6/18, 03 eyes (6.12%) 6/12, another 03 eyes (6.12%) 6/9 and 23 eyes (46.93%) achieved 6/6 after correction with glasses. (Table No. 2).

Thirteen eyes (13) eyes (26.53%) were found with hypermetropia up to +1.00 DSE. Another group of 08 eyes (16.32%) ranged +1.25 to +2.0 DSE. Seven eyes (14.28%) were between +2.25 to +3.00 DSE. Three eyes (6.12%) had hypermetropia of +3.50 to +4.00 DSE. Seven eyes (14.28%) were myopic +1 diopter spherical equivalent, 19 eyes (38.80%) ranged between -1.25 to -2.00 diopter spherical equivalent. Seven eyes (14.28%) were found within the range of -2.25 to -3.00 diopters spherical equivalent. One eye (2.4%) was overcorrected by -4.00 diopters spherical equivalent. Four eyes (08.16 %) ranged from -4.25 to -5.00 diopters spherical equivalent. Two eyes (4.08%) were with in range of -5.25 to +6.00 diopters spherical equivalent. Three eyes (06.12%) revealed under correction up to -1.00 diopter spherical equivalent and 02 eyes (4.08%) by -1.50 and -2.00 diopter spherical equivalent. Two eyes (4.08 %) had residual myopia of -2.50 -3.00 diopters spherical equivalent. Only one eye (2.4%) was emmetropic (Table No. 3). Twenty five eyes (51.02%) had astigmatism of more than +1.00 diopters. Only one eye (02.04%) had astigmatism more than -1.00 diopters. Eighteen eyes (36.75 %) scored grade 1 corneal haze, 23 eyes (46.93%) were given grade 2 corneal haze, and 03 eyes (6.12%) had grade 3 degree corneal haze at one month postoperatively. (Table No.4).

**At six months:** 6/60 visual acuity was recorded in 05 eyes (10.20%), 6/36 in 03 eyes (06.12%), 6/24 in 08 eyes (16.32%), 6/18 in 16 eyes (32.68%), 6/9 in 07 eyes(14.28%) and only 10 eyes (20.40%) reached to 6/6 without glasses at the end of three months follow up visit. (Table No.1). Two eyes (4.08%) achieved 6/60, 04 eyes (8.16%) 6/36, 14 eyes (28.59%) 6/18, 03 eyes (6.12%) 6/12, another 03 eyes (6.12%) 6/9 and 23 eyes (46.93%) achieved 6/6 after correction with glasses. (Table No. 2).

Thirteen eyes (13) eyes (26.53%) were found with hypermetropia up to +1.00 DSE. Another group of 08 eyes (16.32%) ranged +1.25 to +2.0 DSE. Seven eyes (14.28%) were between +2.25 to +3.00 DSE. Three eyes (6.12%) had hypermetropia of +3.50 to +4.00 DSE. One eye (2.4%) presented with hypermetropia of +5.75 DSE. Seven eyes (14.28%) were myopic up to -1.00 DSE. Three eyes (6.12%) were myopic within -1.25to -2.0 DSE, and another three eyes (6.12%) ranged between-2.25 to -3.0DSE, 03 eyes (6.12%) were emmetropic. Proper refraction could not be done in one eye. (TableNo3).Seventeen eyes (34.69%) were left with astigmatism of more than +1.00 diopter. Three eyes (06.12%) with more than -1.00 diopter cylinder. Three months after PRK, 09 eyes (18.36%) showed grade 1 corneal haze, 22 eyes (44.92%) showed grade 2 corneal
haze, 10 eyes (20.40%) showed grade 3 and 03 eyes (6.12%) had grade 4 corneal haze. Rest of the corneas were clear. (Table No.4).

At six months: Forty three (43) eyes from this group appeared for the final visit at six months. They showed the following results:

Three eyes (6.97%) had CF, 12 eyes (27.90%) had 6/60, 03 eyes (6.97%) had 6/36, 06 eyes (13.95%) had 6/24 another 06 eyes (13.95%) had 6/18, 01 (02.32%) had 6/12, 03 eyes (06.97%) had 6/9 and 09 (20.97%) eyes had 6/6 vision without any correction. (Table No.1). 02 (04.65%) had counting fingers, 04 eyes (09.30 %) had 6/60, 03 eyes (06.97%) had 6/36, 02 eyes (04.65%) had 6/24, 07 eyes (16.27%) had 6/18, 04 eyes (09.30%) had 6/12, 05 eyes (11.62%) had 6/9 and 16 eyes (37.24%) had gained 6/6 visual acuity with spectacles. (Table No.2). It was found that 05 eyes (11.62%) had hypermetropia up to +1.00 DS. 05 eyes (11.62%) were grouped in hypermetropia ranging from + 1.25 to +2.0 DS. Three eyes (06.97%) were grouped together with hypermetropia ranging from +2.25 to +3.00 DSE. Another group of 02 eyes (04.65%) had hypermetropia of +3.50 DS. 04 eyes (9.30%) were found with emetropia at six months after surgery. Five eyes (11.62%) had myopia within -1.00 DS, 04 eyes (9.30%) had myopia within -1.25 to -2.0 DS, 06 eyes (13.95%) fell between - 3.00 to -4.00 DS. One eye (02.32 %) had attained myopia of -6.50 DS; another pair of 02 eyes (04.65%) attained -7.50 DS. Still another eye (02.32%) attained -8.25 DS as evaluated, six months postoperatively. Retiniscopy could not be done in five eyes (11.62%). Ten eyes (23.25%) were still overcorrected by more than +1.00 diopter spherical equivalent. Fourteen eyes (33.54 %) had regressed/under corrected by more than -1.00 DS (Table No3). 10 eyes (23.25%) presented with +1.00 diopter cylinder and eleven 11 eyes (25.58%) with more than - 1 diopter cylinder. It was noted that 08 eyes (18.61%) were seen grade 1 haze, 09 eyes (20.94%) with grade 2 degree corneal haze , 16 eyes (37.20%) with grade 3 degree corneal haze and 10 eyes (23.25 %) with 4.0 degree corneal haze. (Table No.4)

DISCUSSION:

Excimer Laser PRK has been shown to be safe, predictable, stable and effective for myopia up to -6.0 diopters by many studies, myopia exceeding this limit, however, has shown contradictory results4. This study was designed to asses the outcome of excimer laser PRK in Pakistani population, for myopia of -6.00 to -20.0 diopters. All the patients experienced moderate to severe pain shortly after the excimer laser application and reported to peak twenty four hours after treatment. It subsided over next two days. We also concluded like other reports that simple analgesics and tranquilizers cannot control post laser pain effectively. It is accepted that combination of the disposable contact lenses and topical Diclofenac sodium (3-4 times a day) gives the best results in suppressing the pain following PRK5. Topical NSAIDS offer several potential benefits over traditional systemic agents for ocular pain relief6. An important routine is that topical steroids should be used in combination with NSAIDS preparations to reduce the incidence of sterile infiltrates7. Despite the introduction of topical non steroidal and bandage contact lenses approximately 5% to 10 % of patients continue to experience moderate to severe pain requiring oral narcotic agent. Ice packs or cold compress can significantly improve comfort level in these patients8. It is also reported that vitamin A and E; significantly decreased re-epithelialization time, haze formation, and myopic regression occurrence9. However pain disappeared completely once the reepithelialization was completed. In general epithelium heals over promptly after PRK10. If mechanical debridement is performed, re-epithelialization occur within 2-4 days8. Epithelial healing usually requires 3 days to complete, but many

<table>
<thead>
<tr>
<th>Table No. 1 Unaided postoperative visual acuity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Acuity</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>CF</td>
</tr>
<tr>
<td>6/60</td>
</tr>
<tr>
<td>6/36</td>
</tr>
<tr>
<td>6/24</td>
</tr>
<tr>
<td>6/18</td>
</tr>
<tr>
<td>6/12</td>
</tr>
<tr>
<td>6/9</td>
</tr>
<tr>
<td>6/6</td>
</tr>
</tbody>
</table>
patients require 4 days and some as long as 1 week\textsuperscript{10}.

In this study group re-epithelialization occurred in 54\% (26 eyes) within 72 hours. Twenty two eyes (44\%) completed healing on fourth postoperative day. Only one eye (02\%) healed in one week. It is comparable with most of the international studies, which has reported completion of re-epithelialization within 72 to 96 hours. Higher refractive errors require deeper ablations as

Table No.2 Best spectacle corrected visual acuity

<table>
<thead>
<tr>
<th>Visual Acuity</th>
<th>1Month (n=49) No. of eyes (%)</th>
<th>3Months (n=49) No. of eyes (%)</th>
<th>6Months (n=43) No. of eyes (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF</td>
<td>0(00.00%)</td>
<td>0(00.00 %)</td>
<td>02(04.65%)</td>
</tr>
<tr>
<td>6/60</td>
<td>03(06.12%)</td>
<td>02(04.08%)</td>
<td>04(09.30%)</td>
</tr>
<tr>
<td>6/36</td>
<td>03(06.12%)</td>
<td>04(08.16%)</td>
<td>03(06.97%)</td>
</tr>
<tr>
<td>6/24</td>
<td>06(12.24%)</td>
<td>00(00.00%)</td>
<td>02(04.65%)</td>
</tr>
<tr>
<td>6/18</td>
<td>07(14.28%)</td>
<td>14(28.59%)</td>
<td>07(16.27%)</td>
</tr>
<tr>
<td>6/12</td>
<td>06(12.24%)</td>
<td>03(06.12%)</td>
<td>04(09.30%)</td>
</tr>
<tr>
<td>6/9</td>
<td>10(20.40%)</td>
<td>03(06.12%)</td>
<td>05(11.62%)</td>
</tr>
<tr>
<td>6/6</td>
<td>14(28.60%)</td>
<td>23(46.93%)</td>
<td>16(37.24%)</td>
</tr>
</tbody>
</table>

Table No.3 Postoperative spherical equivalent refraction

<table>
<thead>
<tr>
<th>Refraction (DSE)</th>
<th>1Month (n=49) No. of eyes (%)</th>
<th>3Months (n=49) No. of eyes (%)</th>
<th>6Months (n=43) No. of eyes (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>+0.25 to +1.00</td>
<td>08(16.32%)</td>
<td>13(26.53%)</td>
<td>05(11.62%)</td>
</tr>
<tr>
<td>+2.25 to +3.00</td>
<td>07(14.28%)</td>
<td>07(14.28%)</td>
<td>03(06.97%)</td>
</tr>
<tr>
<td>+3.25 to +4.00</td>
<td>01(02.04%)</td>
<td>03(06.12%)</td>
<td>02(04.65%)</td>
</tr>
<tr>
<td>+4.25 to +5.00</td>
<td>04(08.16%)</td>
<td>00(00.00%)</td>
<td>00(00.00%)</td>
</tr>
<tr>
<td>+5.25 to +6.00</td>
<td>02(04.08%)</td>
<td>01(02.04%)</td>
<td>00(00.00%)</td>
</tr>
<tr>
<td>-0.25 to -1.00</td>
<td>03(06.12%)</td>
<td>07(14.28%)</td>
<td>05(11.62%)</td>
</tr>
<tr>
<td>-1.25 to -2.00</td>
<td>02(04.08%)</td>
<td>03(06.12%)</td>
<td>04(09.30%)</td>
</tr>
<tr>
<td>-2.25 to -3.00</td>
<td>02(04.08%)</td>
<td>03(06.12%)</td>
<td>00(00.00%)</td>
</tr>
<tr>
<td>-3.25 to -4.00</td>
<td>00(00.00%)</td>
<td>00(00.00%)</td>
<td>06(13.95%)</td>
</tr>
<tr>
<td>-6.50</td>
<td>00(00.00%)</td>
<td>00(00.00%)</td>
<td>01(02.32%)</td>
</tr>
<tr>
<td>-7.50</td>
<td>00(00.00%)</td>
<td>00(00.00%)</td>
<td>02(04.65%)</td>
</tr>
<tr>
<td>-8.25</td>
<td>00(00.00%)</td>
<td>00(00.00%)</td>
<td>01(02.32%)</td>
</tr>
<tr>
<td>0.00</td>
<td>01(02.04%)</td>
<td>03(06.12%)</td>
<td>04(09.30%)</td>
</tr>
</tbody>
</table>

Table No.4 Distribution of corneal haze after PRK

<table>
<thead>
<tr>
<th>Grade</th>
<th>1Month (n=49) No. of eyes (%)</th>
<th>3Months (n=49) No. of eyes (%)</th>
<th>6Months (n=43) No. of eyes (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>05(10.20%)</td>
<td>05(10.20%)</td>
<td>00.00</td>
</tr>
<tr>
<td>1</td>
<td>18(36.75%)</td>
<td>09(18.36%)</td>
<td>08(18.61%)</td>
</tr>
<tr>
<td>2</td>
<td>23(46.93%)</td>
<td>22(44.92%)</td>
<td>09(20.94%)</td>
</tr>
<tr>
<td>3</td>
<td>03(06.12%)</td>
<td>10(20.40%)</td>
<td>16(37.20%)</td>
</tr>
<tr>
<td>4</td>
<td>00.00</td>
<td>03(06.12%)</td>
<td>10(23.25%)</td>
</tr>
</tbody>
</table>
In the regimen for a few days.

Drops (Levobunolol hydrochloride 0.5%) were added three months without any problem. Betagan 0.5% eye mild ones. Mild steroids continued till completion of to 32 mm of Hg. Potent steroids were replaced with eyes). Rise in IOP was confined between 28 mm of Hg and beta-blocker was discontinued in 8 of 273 eyes, all responded promptly to topical beta blockers and returned to normal levels when steroids and beta-blocker was discontinued. Intraocular pressure (IOP) must be monitored while patient is on topical steroid therapy. More frequent monitoring is required if IOP is elevated by 5 to 8 mm of Hg, but still within normal range. It should be kept in mind that IOP may be underestimated with flat corneas post PRK. The higher myopes in this study showed a large variation in uncorrected visual acuity and refractive results during six months follow up. 30.26% eyes were able to read 6/12 or better uncorrected at six months after surgery. Nyström et al, 1995 reported the same result (30%) after nine months follow up for myopia from -10.00 to -18.00 diopters. None of the eyes in this study group lost best corrected visual acuity, though loss of one or two lines is not uncommon after excimer laser PRK. As the data indicates that postoperative spherical equivalent refraction was with in +/- 1.00 diopters in 10 of 43 eyes (23.25%), within +/- 1.25 to +/- 2.00 in 9 of 43 eyes (20.93%). Five of 43 eyes were (11.62%) were overcorrected by +2.25 to +3.75 DS and 10 of 43 eyes (23.25%) were under corrected/ regressed by more than -3.00 DS at six months follow up. Four (09.30%) were emmetropic. 14 of 43 eyes (32.55%) regressed by more than -1.0 DS. This study had shown that density and distribution of corneal haze gradually increased and no decrease in corneal haze was observed even after six months. All the eyes presenting at six months had corneal haze of various degree. Chan et al, 1995, studied high myopia (-6.00 to -18.00 diopters) and reported that 77% of the eyes had none or trace corneal haze, 23% had mild to moderate corneal haze. As compare to other international studies relatively greater corneal haze was observed in our population. Corneal haze has been described variously in different studies. This may be due to the fact that grading the haze being used at present is not objective and grading may differ from report to report. This higher incidence of corneal haze, compare to other reports may be due to the greater depth of ablation required to correct high myopia resulting in an aggressive wound healing tissue response in our population like elsewhere in the body.

The literature suggests that the results of excimer laser surgery to correct myopia are more variable for high and extreme myopia. Predictability of refraction and uncorrected and best corrected visual acuity progressively decreases with increasing myopia. The likelihood of losing lines of best corrected visual acuity and corneal haze has tendency to increase with increasing myopia. Therefore patients with higher degrees of myopia are more likely to show some regression and under correction to the extent that a second ablation may be required. Major disadvantage of PRK (especially for high myopia) is that the procedure is performed over visual axis and patient who experience exuberant healing will develop visual haze usually temporary, rarely it can have permanent scarring of the cornea. Though we had our share of complications, but none was vision threatening permanently.

CONCLUSION:

It seems that postoperative haze in high myopia is the most significant problem in our population. Predictability and stability decreases with increase in diopteric power and ablation depth as does the corneal haze. High myopes showed more postoperative haze and regression on initially achieved effect, compromising the predictability and the stability of the procedure.

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The effect of Intracameral Preservative free 1% Xylocaine on the Corneal Endothelium during Phacoemulsification Procedure

Mushtaq Ahmad FCPS¹, Muhammad Naeem², Hina Mehwish Khan³, Sanaullah Khan FCPS⁴

ABSTRACT

Purpose: To evaluate the effect of intracameral preservative-free 1% xylocaine on the corneal endothelium as an adjuvant to topical anaesthesia during phacoemulsification cataract surgery.

Material & Methods: This is a randomized control trial containing 96 patients with soft to moderately dense (Grade 1-3) senile cataract and corneal endothelial cell density of >1500/mm² were randomized into two groups one was xylocaine group (n=48) and control group (n=48). Central endothelial specular microscopy and ultrasound corneal pachymetry were performed preoperatively. On the first postoperative day the eyes were evaluated for corneal oedema and Descemet's folds. Ultrasound corneal pachymetry was performed at 1, 3 and 12 months. Specular microscopy was performed at 3 and 12 months. Cell loss was expressed as a percentage of preoperative cell density. Six patients could not complete one year follow-up. Chi-square and paired t test (2 tail) statistical tests were applied for analysis.

Results: Four (8.33%) patients in the xylocaine group and 5 (10.41%) in the control group had a few Descemet's folds associated with mild central stromal oedema. Corneal thickness increased from 549.3µ ± 37.2µ to 555.5µ ± 36.5µ in the xylocaine group and from 553.1µ ± 36.2µ to 559.3µ ± 40.5µ in the control group at the one-month postoperative visit. Thickness returned to the preoperative level in xylocaine group 549.6µ ± 34.5µ and control group 554.7µ ± 41.1µ at three months. (P=0.484) The percentage of cell loss was 4.47 ± 2.53% in the xylocaine group and 4.49 ± 3.09 % in the control group at one year. (P=0.97)

Conclusion: Intracameral preservative-free 1% xylocaine does not appear to affect corneal endothelium adversely during phacoemulsification.

Keywords: Topical anaesthesia, phacoemulsification, intracameral xylocaine, endothelial specular microscopy, ultrasound corneal pachymetry

INTRODUCTION

Topical and intracameral anaesthesia are new options for pain management in phacoemulsification. Injection of anaesthetic agents has been associated with complications such as ocular perforation, retrobulbar haemorrhage, retinal vascular occlusion, optic nerve trauma and extraocular muscle malfunction¹,². Topical anaesthesia has advantage of rapid visual recovery after phacoemulsification.³ Topical anaesthesia for cataract surgery, popularised by Fichman, has been in use since 1992.⁴ Though peribulbar anaesthesia gives akinesia, phacoemulsification can be performed satisfactorily without inducing akinesia. Topical anaesthesia has gained wide acceptance as an effective, efficient, practical and safe form of ocular anaesthesia for clear corneal phacoemulsification.⁵ The survey of members of the American Society of Cataract and Refractive Surgeons (ASCRS) in 2000 revealed an increase in the use of topical anesthesia to 49% of surgeons from 5% in 1995 and 45% in 1999.⁶ However, topical anaesthesia alone may not work in certain cases because of pain and discomfort arising from frequent pressure changes during phacoemulsification. Gills suggested preservative-free 1% xylocaine for intracameral anaesthesia to control intraoperative discomfort.

Since the introduction of intracameral anaesthesia in cataract surgery, many investigational and clinical studies have verified its safety postoperatively.⁷ Nevertheless, some authors advise caution with the use of intracameral anaesthetic agents because of their possible toxic effects on intracocular structures, in particular damage to the corneal endothelium.⁸ Changes in the ultrastructure of corneal endothelial cells and an increase in polymorphism and cellular oedema have been reported.⁹ Such alterations also occur with preservative-free 1% xylocaine, the concentration most often used for intracameral anaesthesia in cataract surgery.¹⁰ This study evaluated the longterm effect of...
intracameral preservative-free 1% xylocaine on endothelial cell loss after phacoemulsification with foldable IOL implantation in Indian patients and compared the endothelial cell loss rate with that following topical anaesthesia alone.

**MATERIAL AND METHODS**

This is a randomized control trial conducted at ophthalmology department HMC from March, 2011 to March, 2012. It comprised 96 patients scheduled for phacoemulsification under topical anaesthesia. Patients with soft to moderately dense senile cataract (Grade 1 to 3 on a scale of 1 to 5) and corneal endothelial cell density of >1500/mm² were included in the study. Obese and short-necked patients were also included. Patients with hard cataract (grade 4 and 5), uveitis, glaucoma, previously operated eye, a single eye and white mature cataract were excluded. Patients with diabetes, hypertension and those with whom communication could not be established, for reasons such as hearing disability or language barrier were also excluded.

Patients were evaluated for visual acuity on Snellen's chart, intraocular pressure (IOP) and anterior segment pathology. The endothelium was examined by slit lamp with 16 X magnification for changes like guttatae. Fundus examination was done with direct and indirect ophthalmoscope. Specular microscopy photographs of the corneal endothelium were taken with a Konan SP 8000 nonconROBO specular microscope (Konan Medical, Inc, Japan). The endothelial cell density (CD) was estimated counting cell numbers by a computer assisted measuring system after 100 cells in a cluster. Cell density is one of the most important indices. Cell density of 2000 cells/mm² or more is considered normal. The specular microscope is programmed to select a central location which can be confirmed by a highlighted mark on the monitor. This central location was standardised in all patients. However, it is possible that measurements were not taken at exactly same location. Ultrasound corneal pachymetry (Humphrey Instruments Inc.) was done in the center of the cornea by advising the patient to look at the fixation light. Once again there was a possibility of missing the same point every time.

Using the envelope method patients were randomly assigned to receive either 0.2 ml preservative-free 1% xylocaine (xylocaine group) or BSS (control group). The surgeon and observer were masked to the randomization. The technique of anaesthesia and surgery was standardised. All surgeries were performed under topical anaesthesia. 4% xylocaine was instilled twice at intervals of 5 minutes during preoperative preparation. Xylocaine was reinstilled just prior to the placement of the temporal corneal incision and also before enlargement of incision for intraocular lens implantation. This technique was followed in all cases. Additional supplementation for breakthrough pain during surgery was given based on the surgeon’s subjective impression when the patient complained of pain. If wound integrity was suspected, supplementation with topical 4% xylocaine was avoided just prior to intraocular lens insertion. Surgeries were done by a single surgeon. After making a 3.5 mm pre-planned superior corneal tunnel, either 0.2 ml preservative-free 1% xylocaine or BSS was injected in the anterior chamber through main tunnel. After 20 seconds, 2% HPMC was injected. Anterior capsulorhexis was performed under methylcellulose followed by hydrodissection and rotation of nucleus. Our phacoemulsification technique includes initial sculpting followed by step-by-step chop-in situ and lateral separation and stuffing of nucleus fragment with the stop, chop, chop and stuff technique. Cortex removal was done with irrigation aspiration cannula. AcrySof I. Qwas implanted in the bag through injector. Intraoperative details like average phaco power, total phaco time and total infusion fluid volume were noted. Postoperatively, eyes were evaluated for presence or absence of corneal oedema and Descemet’s folds. Quantification of aqueous flare and cells were made using Hogan’s criteria. Intraocular pressure and visual acuity were also recorded. Eyes were examined on day 1, at 1 week and 1, 3, 6 and 12 months postoperatively. Ultrasound corneal pachymetry was performed at 1, 3 and 12 months. Endothelial specular microscopy was performed at 3 and 12 months and parameters like cell density, coefficient of variation and hexagonal cells were recorded. All the readings of specular microscopy and corneal pachymetry were performed by a single observer to avoid bias, both pre and postoperatively. Chi-square and paired t Test (2 tail) were applied for statistical analysis.

**RESULTS**

Six patients could not complete more than 6 months of follow-up as four had to travel a considerable distance and two died during the period. Average follow-up was 12 months. Demography, preoperative intraocular pressure, infusion fluid volume used and cumulative dissipated energy are comparable in both groups as shown in Table - 1. 4 (7.54%) patients in xylocaine and 5 (9.43%) patients in control group had a few Descemet’s folds associated with mild central stromal oedema on first postoperative day. All corneas had cleared at the one week visit. Uveal inflammatory response as noted on first postoperative day was not statistically significant (P=0.662). IOP on first postoperative day was on average of 14.4 ± 2.8 mmHg in xylocaine group and 14.4 ± 3.6 mmHg in...
control group (P=0.895)Table - 2. Three patients in xylocaine group had an IOP of 32, 28, 27 mmHg respectively. These patients on second postoperative day had an IOP of 14, 17, 15 mmHg with Timolol maleate 0.5% eye drops twice a day. Similarly in the control group, four patients had an IOP of 30, 29, 24, 23 mmHg. On second postoperative day IOP recorded was 17, 15, 18, 14 mmHg respectively with Timolol maleate 0.5% eye drops twice a day. Best spectacle visual acuity at one year was >6/12 in 48 (90.57%) patients of the xylocaine group and 47 (88.67%) patients of the control group (P=0.646). The other two patients of the xylocaine group had 6/18 best spectacle visual acuity due to age related macular degeneration (ARMD). In the control group two patients with ARMD had 6/18 and one with amblyopia had 6/24 best spectacle visual acuity. Percentage of cell loss is comparable in both groups at the 3 and 12-month postoperative visit. No patient needed conversion to injection anaesthesia. No patient developed serious complications such as posterior capsule rupture, vitreous loss or zonular dialysis.

**DISCUSSION**

Topical anaesthesia for phacoemulsification has gained popularity since the introduction of clear corneal incision.13 Better understanding of phacodynamics, improved surgical skill and use of foldable IOLs also have helped popularise topical anaesthesia. Globe manipulation can be done easily to the surgeon’s comfort during surgery under topical anaesthesia. It is particularly valuable in cases of one eyed anaesthesia. It is particularly valuable in cases of one eyed patients as all possible complications of peribulbar and retrobulbar anaesthesia are avoided. Selection criteria would vary from surgeon to surgeon. Preoperative counseling and intraoperative communication improve the surgical performance and the final outcome. Topically applied xylocaine effectively penetrates the eye through the cornea and can be found in aqueous humour at levels that involve analgesic activity.14 but in patients with anxiety and complicated ocular history as in cases of prolonged surgical time, topical anaesthesia alone may not be sufficient. Pressure changes induced by sudden deepening of the anterior chamber during phacoemulsification are more frequent in young individuals, high myopic and in post vitrectomised eyes. In situations like these intracameral xylocaine has been found beneficial.

Intracameral xylocaine appears to act by two mechanisms. (1) “Uveal anaesthesia” - decrease the sensation induced by stretching of iris root, ciliary body and zonules during inflation-deflation of globe. (2) Decrease sensitivity to microscope light by anaesthetic effect on the retina-ganglion cell-optic nerve complex. Studies have shown that high concentrations intracameral xylocaine (2% or 4%) are toxic to the corneal endothelium and cause corneal oedema. 1% xylocaine hydrochloride is safe. A survey of ASCRS members in 2000 revealed that 82% of the surgeons using topical anesthesia used it in combination with intracameral preservative-free 1% xylocaine.

This study addresses the long term safety of intracameral xylocaine. We have included soft to moderately dense cataracts (Gr. 1 to 3). As the effect of hard cataract emulsification on endothelium is multifactorial, we have excluded grade 4 and 5 cataracts.15 We also feel that the effectiveness of the drug could be different in diabetic and hypertensive patients. Flare and cells response in immediate postoperative period was acceptable in both groups. There was short-term rise of the IOP in 3 (6.25%) patients of the xylocaine group and in 4 (8.33%) patients of the control group. The glaucoma was controlled with topical timolol maleate 0.5% and no patient required longterm antiglaucoma medications.

We could not explain the increase in IOP in these patients. They did not have exaggerated postoperative inflammatory response and there was no history of glaucoma in any patient. The changes produced in endothelium cell density, hexagonality and coefficient of variation in cell area are informative in evaluating the safety of new agents for intracameral use.16 Preoperative specular parameters and pachymetry were comparable in both xylocaine and control groups.

### Table 1. Demographic data and operative detail

<table>
<thead>
<tr>
<th></th>
<th>Xylocaine (n:48)</th>
<th>Control (n:48)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>58± 7.78</td>
<td>56± 7.2</td>
<td>0.14</td>
</tr>
<tr>
<td>Male</td>
<td>35(72.91%)</td>
<td>33(68.75%)</td>
<td>0.87</td>
</tr>
<tr>
<td>Female</td>
<td>13(27.08%)</td>
<td>15(31.25%)</td>
<td>0.87</td>
</tr>
<tr>
<td>Fluid used</td>
<td>324.9± 117.2</td>
<td>295.7± 91.2</td>
<td>0.14</td>
</tr>
<tr>
<td>CDE</td>
<td>0.765± 0.336</td>
<td>0.66± 0.297</td>
<td>0.12</td>
</tr>
<tr>
<td>IOP9(mmHg) Preoperative</td>
<td>13.8± 3.7</td>
<td>14.1± 3.9</td>
<td>0.78</td>
</tr>
</tbody>
</table>

### Table 2. Postoperative outcome: First postoperative day

<table>
<thead>
<tr>
<th></th>
<th>Xylocaine (n:48)</th>
<th>Control (n:48)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cornea- Clear</td>
<td>44(91.66%)</td>
<td>43(89.58%)</td>
<td>0.75</td>
</tr>
<tr>
<td>Descemets folds</td>
<td>4(8.33%)</td>
<td>(10.41%)</td>
<td></td>
</tr>
<tr>
<td>Cells - Mild</td>
<td>38(79.16%)</td>
<td>37(77.07%)</td>
<td>0.66</td>
</tr>
<tr>
<td>Moderate</td>
<td>8(16.66%)</td>
<td>8(16.66%)</td>
<td></td>
</tr>
<tr>
<td>Severe</td>
<td>2(4.16%)</td>
<td>3(6.80%)</td>
<td></td>
</tr>
<tr>
<td>IOP(mmHg)</td>
<td>14.4+2.7</td>
<td>14.4+3.5</td>
<td></td>
</tr>
</tbody>
</table>
Though preoperative cell density is less than other reported studies, it represents the cell density in the Pakistani population.

In our study, 4 (8.33%) eyes in xylocaine group and 5 (10.41%) eyes in control group developed Descemet’s folds and mild central stromal oedema on first the postoperative day. As genesis of oedema near the incision is multifactorial, we decided to focus on central corneal oedema. All corneas cleared within a week. Percentages of cell loss in our study are within the range reported by other authors. There was no significant difference in specular parameters both pre and postoperatively in patients who developed corneal stromal oedema compared to the patients without stromal oedema postoperatively. Pachymetry gives useful information of the endothelial function. As reported in previous studies corneal thickness returns to the preoperative level by 3 months postoperatively.

A few studies reported in the literature had a study design similar to ours with xylocaine and control groups. All these studies did not report any significant change on the study eyes with intracameral xylocine. Several other studies have used injection anaesthesia as a control group. These studies also did not show any significant endothelial cell loss in the study or the control eyes. The study by Heuermann et all with follow-up of 20 months reported that longterm postoperative endothelial cell course with topical anaesthesia combined with intracameral injection of preservative-free 1% xylocaine is a safe alternative to peribulbar anaesthesia. Similarly, our study evaluated longterm endothelial cell loss and found no statistically significant differences between topical anaesthesia combined with intracameral preservative-free 1% xylocaine (xylocaine group) and topical anaesthesia with injection of BSS (control group) one year after surgery.

Although we have not done fundus fluorescein angiography, there was no evidence of macular oedema on fundus examination. There was no evidence of phototoxicity. In summary, intracameral preservative-free 1% xylocaine does not appear to affect the corneal endothelium adversely during phacoemulsification.

CONCLUSION

Intracameral preservative-free 1% xylocaine does not appear to affect corneal endothelium adversely during phacoemulsification.

REFERENCES:

Postoperative Endophthalmitis, role of Subconjunctival Antibiotics Intraoperatively during Cataract Surgery

Muhammad Naeem1, Mushtaq Ahmed FCPS2, Hina Mehwish Khan3, Yousaf Jamal Mesud4, Tariq Shehnam5

ABSTRACT

Purpose: To determine role of subconjunctival antibiotics regarding prevention of postoperative endophthalmitis after cataract surgery.

Material and Methods: The study was conducted in the Department of Ophthalmology at Hayatabad Medical Complex, Peshawar, from 1st January 2010 to 30th June 2011. In this study evaluation of 800 eyes listed for senile cataract surgery were randomized into two groups, one received subconjunctival gentamicin at the end of the surgical procedure and the other group did not receive any subconjunctival antibiotic. All other methods of sterilization and prophylaxis were standardized for both the groups. All patients received antibiotic-steroid combination eye drops postoperatively and were followed up for six weeks. Patients with any major intraoperative complication or who were lost to follow-up were excluded.

Results: A total of 760 eyes were included in the study. Females patients were 372 (48.94%) and the mean age of patients was 61.66 years. Manual small incision cataract surgery (MSICS) with IOL was performed in 470 (61.84%) patients, phacoemulsification with IOL in 290 (38.15%) patients. Subconjunctival gentamicin injection was given in 400 (52.63%) patients at the end of the procedure, while 360 (47.36%) eyes were not injected. Only 01 case developed postoperative endophthalmitis, and this case was given subconjunctival antibiotic injection during manual small incision cataract surgery with IOL.

Conclusion: Cataract surgery with subconjunctival gentamicin seems to be no role in prevention of endophthalmitis.

Key words: Endophthalmitis, Phacoemulsification, Manual small incision cataract surgery.

INTRODUCTION

Postoperative endophthalmitis, though rare, is one of the most devastating complications of intraocular surgery. It is also the most common form of endophthalmitis, accounting for approximately 70% of infective endophthalmitis. In approximately 30-45% of cataract operations, intraocular contamination occurs with facultative pathogenic bacteria from the ocular surface without the development of endophthalmitis. The infectious agent generally enters the eye during intraocular surgery (postoperative), following a penetrating injury of the globe (post traumatic) or from hematogenous spread of bacteria to the eye from a distant anatomical site (endogenous). Although uncommon, endophthalmitis can also result from infective keratitis if left untreated.

The incidence of postoperative endophthalmitis varies from 0.05 to 0.2% (1/2000 to 1/500 cataract operations). At present there is no clear robust evidence with regards to, which prophylactic methods to use to prevent postoperative endophthalmitis after cataract surgery. Most surgeons empirically use a variety of prophylactic techniques including preoperative topical antibiotics, povidone-iodine preparation for periocular skin and conjunctival instillation, intraoperative antibiotics both intracameral and subconjunctival and postoperative antibiotics topical or systemic. Our aim of this study was to determine the role of gentamicin injection in prevention of post operative endophthalmitis.

MATERIAL AND METHODS

Patients listed for senile cataract surgery were randomized into two groups. One received subconjunctival gentamicin injection 20 mg / 0.5 ml at the end of the surgical procedure and the other group did not receive any subconjunctival injection. All the methods of sterilization were standardized for both the groups. These methods included: 1. Pre-operative moxifloxacin eye drops single drop every half an hour starting two hours before surgery. 2. Povidone-iodine 10% over and around the eyelids. 3. Povidone - iodine 5% eye drops for conjunctival instillation. 4. Proper
draping, covering the eye lashes and lid margins. 5. Standard sterilization of surgical instruments. 6. Standard scrubbing of the surgeon and assistant. 7. Single drop of moxifloxacin eye drops at the end of surgery. All patients received antibiotic-steroid combination eye drops postoperatively, and were followed up for six weeks to assess for onset of postoperative endophthalmitis. Patients were seen on 1st day, one week and then six weeks postoperatively. Patients were asked to contact urgently if they develop any redness, pain or blurring of vision. The software SPSS version 11 was used for data analysis.

RESULTS

A total of 800 eyes of 724 patients were initially included in the study. We excluded 40 eyes due to either an intraoperative complication or due to loss of follow-up. The mean age of our patients was 61.60 years. Females constituted 372 (48.94%) cases. Table 1 shows that, Manual small incision cataract surgery (MSICS) with IOL was performed in 470 (61.84%) cases. Subconjunctival gentamicin injection was given in 400 (52.63%) eyes at the end of the procedure, and this group included different types of surgeries, Manual small incision cataract surgery and phacoemulsification as shown in Table 2. Only one case developed postoperative endophthalmitis, and this case was given subconjunctival antibiotic injection during manual small incision cataract surgery with IOL. The endophthalmitis was diagnosed clinically; culture was negative on vitreous tap. It was treated with intravitreal ceftazidime and the vision recovered to 6/18. The incidence of postoperative endophthalmitis in our study was 0.13%.

DISCUSSION

Postoperative endophthalmitis is one of the most feared complications following intraocular surgery and it is the second common cause of endophthalmitis after trauma in Pakistan with poor visual outcome. However, due to the low incidence of postoperative endophthalmitis, it has been difficult to assess the efficacy of various prophylactic measures. There are two approaches for prophylaxis; the first is to reduce ocular surface flora by using topical antiseptic preparation or antibiotics and the second is, to eradicate bacteria that enter the eye during surgery, by the use of antibiotics through intracameral, subconjunctival, topical or systemic route.

The most common source of organisms in postoperative endophthalmitis is the patient’s own ocular surface flora, so it is recommended to instill preoperative 5% povidoneiodine in the conjunctival sac. A review by Ciulla has found that povidone iodine antisepsis of skin, lids and conjunctiva to be the only recommended practice on the basis of the current evidence. Ciulla TA had also reported that, all other prophylaxis interventions (including preoperative lash trimming, preoperative saline irrigation, preoperative topical antibiotics, antibiotic-containing irrigating solutions and postoperative subconjunctival antibiotic injection) are possibly relevant but not definitely related to clinical outcome. The European Society of Cataract and Refractive Surgeons (ESCRS) guideline on prevention of postoperative endophthalmitis recommend intracameral cefturoxime and does not encourage subconjunctival antibiotics for three reasons; 1. Intracameral cefturoxime achieves higher aqueous concentration after surgery than subconjunctival cefturoxime. 2. The use of subconjunctival antibiotics has been questionable in their affectivity in preventing postoperative endophthalmitis. 3. The potential complications caused by subconjunctival injections like subconjunctival haemorrhage and penetration of sclera and the extraocular muscles.

However subconjunctival antibiotics have been a standard method used to prevent postoperative endophthalmitis all over the world, including Pakistan and the great majority of United Kingdom surgeons routinely gives subconjunctival antibiotics at the end of cataract surgery, and that is due to the concerns regarding ocular toxicity from intracameral antibiotics. Lehmann OJ and Ng JQ in their studies had favoured the use of subconjunctival antibiotics as prophylaxis against endophthalmitis and reported that it reduces the risk by 50%. To change our routine practice we did this study, which showed no case of endophthalmitis in 180 cases that were not given subconjunctival injections. It had proved that not using subconjunctival antibiotics did not put patients on extra risk of getting endophthalmitis. Incidentally endophthalmitis occurred in one case out of 200 eyes.

<table>
<thead>
<tr>
<th>Table:1 Types of surgery</th>
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<tbody>
<tr>
<td>Types of surgery</td>
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<tr>
<td>--------------------------</td>
</tr>
<tr>
<td>MSICS: Manual small incision cataract surgery</td>
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<table>
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<th>Table:2 Sub conjunctival antibiotics in different types of surgeries</th>
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<tr>
<td>Surgical procedure</td>
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<tr>
<td>-------------------</td>
</tr>
<tr>
<td>MSICS+IOL</td>
</tr>
<tr>
<td>Phaco+IOL</td>
</tr>
<tr>
<td>Total</td>
</tr>
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</table>
which were given subconjunctival gentamicin injection. This patient underwent manual small incision cataract surgery with IOL. In this study regarding the patterns of endophthalmitis prophylaxis in Canada it was reported that only 26% of surgeons give intraoperative antibiotics intracameraly or subconjunctivally, while the majority of surgeons (74%) are using similar methods of prophylaxis as were used in our study like perfect draping technique and instillation of povidone iodine 5% into the conjunctival sac prior to surgery. The limitation of this study may be that we included only senile cataract. We excluded all other surgeries along with any eventful surgery such as posterior capsular tear or vitreous loss which carries a significant risk for the development of postoperative endophthalmitis. This was done to avoid any extra risk to be put on patients with high risk.

CONCLUSION

Cataract surgery with subconjunctival gentamicin seems to be no role in prevention of endophthalmitis.

REFERENCES

Penetrating Keratoplasty: Indications, Visual outcomes, and Complications in Tertiary Care Hospital

Afzal Qadir¹, Mir Zaman², Umer Khan³, Ashfaq-u-Rehman⁴, Inayat ullah Khan⁵

ABSTRACT
Purpose: To evaluate the indications, visual outcomes, and complications of penetrating keratoplasty in tertiary care hospital Khyber Pakhtoonkhwa (KPK).

Material and Methods: Retrospective case series of 441 patients of penetrating keratoplasty (PKPs) which was performed by a single experienced surgeon in a tertiary care teaching hospital in the Department of Khyber Institute of Ophthalmic Medical Sciences (KIOMS), Hayatabad Medical Complex, Peshawar from May 2004 to May 2011. Preoperative evaluation for indications, surgical technique, operative, postoperative complications, and Snellen acuity were analysed.

Results: In our total 441 patients 315 (71.42%) were male and 126 (28.58%) were female. In 275 patients right eye while in 171 patients left eye was involved. Age range (5-70 years), mean age group was 40 years. Mean follow-up was 18 months (1-24 months). The most common indication for keratoplasty was keratoconus 305 (69.16%), followed by infected corneal ulcer 41 (9.29%) and corneal scar 24 (5.44%). Pre-operative visual acuity were counting fingers in 265 (60%) of patients. 6/60 – 1/60 in 176 (40 %) of patients. Post-operatively 150 (34%) patients had best corrected visual acuity of 6/6 – 6/12. In 130 (29.47%) of patients had a best corrected visual acuity of 6/18 – 6/36.

Most common complication was astigmatism, posterior sub capsular cataract, toxic anterior segment syndrome, graft failure and rejection.

Conclusions: PK is currently an effective long-term treatment option for improving visual function in various corneal diseases depending upon the underling cause. Keratoconus and infective corneal ulcer were the most common indication for PK in our setup.

Keywords: Corneal transplantation, graft survival, visual acuity, complications.

INTRODUCTION
The cornea is normally avascular tissue that refracts or bends light rays as they enter the eyes allowing them to focus on the retina.¹,² Penetrating keratoplasty (PK) is a corneal transplant procedure in which full thickness diseased host corneal tissue is replaced with healthy donor corneal tissue.³ Corneal transplant is the most common tissue transplant world wide.⁴ Modern day success of transplantation is attributed to eye bank storage techniques, ocular pharmacology and improved surgical techniques.⁵,⁶ Keratoplasty may lamellar or full thickness. Lameller keratoplasty: which is a partial thickness corneal grafting and penetrating keratoplasty: is a full thickness corneal grafting. The indications of keratoplasty include; optical to improve visual acuity by replacing the opaque host tissue by a healthy donor cornea.

Tectonic in patients with stromal thinning, descemetoceles and corneal perforation to preserves corneal anatomy and integrity. Therapeutic is removal of inflamed or infected corneal tissue refractive to treatment by antibiotics or antiviral drugs. Cosmetic in patients with corneal scar giving a whitish opaque hue to the cornea.⁷

The purpose of penetrating keratoplasty in majority of cases is to improve visual acuity, followed by relief from pain and to save the globe integrity. The indication for penetrating keratoplasty is not only varied country to country but institution to institution in the same country.⁸ If corneal perforation seems likely, urgent management is required, since corneal perforation has high morbidity and keratoplasty is a common procedure.⁹

METHODS AND MATERIALS:
Retrospective case series of 441 patients of penetrating keratoplasty (PKPs) which performed by a single experienced surgeon in a tertiary care teaching hospital of Khyber Pakhtoonkhwa in the Department of Khyber Institute of Ophthalmic Medical Sciences (KIOMS), Hayatabad Medical Complex, Peshawar from May 2004 to May 2011. All patients were admitted. Informed consent was signed and prepared for local or general anesthesia. Preoperative evaluation were done with detail history of ocular and systemic diseases,
family history of ocular and systemic diseases, drug history with previous record if available, socioeconomic status of the patient. Recipient factors included age, indication for transplantation, prior grafts, preoperative ocular conditions (glaucoma, uveitis, infection, ocular surface disease, and corneal vascularisation (number of quadrants of superficial and deep vascularisation) anterior segment and posterior segment slit lamp examination with high magnification, as well as indirect ophthalmoscopy to look for posterior segment pathology and systemic examination were performed. B-scan ultrasonography was performed in suspected cases, corneal topography in keratoconus patients, to get proper diagnosis for surgical indications. Operative, postoperative complications, and best corrected Snellen acuity were analysed. Associated surgical procedures at the time of surgery, such as intraocular lens (IOL) implantation, exchange or removal were also documented.

**Surgical technique:**

Corneal transplantation was performed in all cases by a single experienced surgeon. Donor cornea was obtained from Murad Eye Bank of the Hospital inspected and then trephined. The donor cornea was sutured to the recipient using 10/0 nylon interrupted sutures as a routine, and subconjunctival antibiotic and steroid were given. The Eye was bandaged with contact lens. If required, Cataract extraction was performed using an extracapsular technique following a can opener or continuous curvilinear capsulorhexis. Soft lens matter was aspirated using manual Simco aspiration. Insertion of an IOL was decided on a case-to-case basis.

Routine postoperative medication consisted of topical dexamethason combined with topical tobramycin antibiotic one hourly daily for one week. Following discharge, the patient was examined on weekly basis for the first month, fortnightly for three months and monthly for one year. Topically, antibiotic was reduced over the subsequent postoperative month and dexamethason tapered down over 3 months with a change to fluromethalon 0.1% once daily for six months. All sutures were generally removed between 12 and 24 months. Following removal, steroids were increased to four times daily and reduced to once daily over 1 week with covering antibiotics. In general, episodes of immunological endothelial transplant rejection were treated with hourly prednisolone 1% for 1 week and reduced dependent on response. In severe cases, a single pulsed dose of i.v. methylprednisolone 500mg has been used. Transplant failure was defined as described by Price et al. The timing of transplant failure was defined as the time of the first postoperative examination when the corneal graft was described as failed. Graft failure because of endothelial decompensation was considered secondary to rejection if evidence of keratic precipitates and endothelial rejection lines or definite episodes of rejection had been documented.

**RESULTS:**

Out of total 441 patients 315 (71.42%) were male and 126 (28.58%) were female. In 275 patients right eye while in 171 patients left eye were involved. Age ranged from (5-70 years), mean age group was 40 years. Mean follow-up was 18 months (1-24 months). The most common indication for keratoplasty was keratoconus which were 305 (69.16%) of the patients, followed by infective corneal ulcer 41 (9.29%) of the patients. Corneal scar were 24 (5.44%), pseudophakic bullous keratopathy 20 (4.53%), aphakic bullous keratopathy 13 (2.94%), band keratopathy were 08 (1.81%), Fuch’s endothelial dystrophy were 10 (2.26%), Corneal macular dystrophy were 09 (2.04%). Re-grafting were done in 10 (2.26%) of patients. In total 441 patients 25 (5.66%) had gone under open sky procedure. In all these cases pre-operative and post-operative snellen visual acuity assessment was done. Pre-operative visual acuity were counting fingers in 265 (60%) of patients while 6/60 – 1/60 in 176 (40%) of patients. Which improved post operative by 6/6 – 6/12 in 150 (34.0%), followed by 130 (29.47%) had 6/18 – 6/36. One (2%) had become no perception of light (NPL) shown in table II. Toxic anterior segment syndrome was observed in 05 (1.337%) of patients. Secondary glaucoma occurred in 23 (5.21%) of patients. Graft rejection occurred in 38 (8.61%) of patient in the mean interval of 4 months. While graft failure occurred in 27 (6.12 %) of patients. Posterior sub capsular cataract was observed in 05 (1.337%) of cases. 130 (29.47%) of patients had astigmatism were corrected with glasses or contact lenses. Hyphaema occurred in 07 (1.5%) of cases. Paretic pupil (iris sphincter paralysis fixed mid-dilated pupil) occur in 03 (0.68%) of patients.
DISCUSSION:
Penetrating keratoplasty (PK) can visually rehabilitate many of those who suffer from blindness or visual impairment due to corneal diseases. The prognosis, however, is dependent on the pathology responsible for causing corneal blindness or visual impairment. The purpose of this study was to document the indication of penetrating keratoplasty in tertiary care hospital of the province.

Keratoconus remain the most common indication 69.16% for penetrating keratoplasty in our series which can better be compared with national and international studies, while a study by Ngamti et al in Maharaj Nakorn hospital showed that the leading indications for PK were bullous keratopathy (28.9%), which is (7.47%) in my study because of socioeconomic factor.

Mohammad H D et al had performed PK in 43% for corneal scar, and 20% for keratoconus. The rate of corneal transplant rejection in most studies is between 9.9 and 17.2%, and we had a graft rejection rate of 8.61% and failure rate of 6.12% which occur in patients with corneal ulcer, superficial and deep corneal visual acuity 6/12 or better in 34% of cases and 6/18 – 6/36 in 29.47% of cases as compare with Bhatti et al 33.3% and 41.7% respectively. Spontaneous loosening or breakage of sutures occurred in 40 patients (9.07%) and suture related absceses were seen in 12 patients (2.72%) at an average of 6 months follow-up.

CONCLUSION
PK is currently an effective long-term treatment option for improving visual functions. Depending upon the underline cause. Keratoconus and infective corneal ulcer remain the most common indication for PK in our setup.

REFERENCES:

Table I: Indication for Keratoplasty (N-441)

<table>
<thead>
<tr>
<th>Indications</th>
<th>No of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keratoconus</td>
<td>305 (69.16%)</td>
</tr>
<tr>
<td>Infective corneal ulcer</td>
<td>41 (9.29)</td>
</tr>
<tr>
<td>Corneal scar</td>
<td>24 (5.44%)</td>
</tr>
<tr>
<td>Pseudophakic bullous keratopathy</td>
<td>20 (4.53%)</td>
</tr>
<tr>
<td>Aphakic bullous keratopathy</td>
<td>13 (2.94%)</td>
</tr>
<tr>
<td>Band keratopathy</td>
<td>08 (1.81%)</td>
</tr>
<tr>
<td>Fuch’s endothelial dystrophy</td>
<td>10 (2.26%)</td>
</tr>
<tr>
<td>Corneal macular dystrophy</td>
<td>09 (2.04)</td>
</tr>
<tr>
<td>Regrafting</td>
<td>10 (2.26%)</td>
</tr>
<tr>
<td>Total</td>
<td>441</td>
</tr>
</tbody>
</table>

Table II: Pre-operative and post-operative visual acuity (N-441)

<table>
<thead>
<tr>
<th>Visual acuity</th>
<th>Preoperative</th>
<th>Postoperative</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/6 – 6/12</td>
<td>0</td>
<td>150 (34%)</td>
</tr>
<tr>
<td>6/18 – 6/36</td>
<td>0</td>
<td>130 (29.47%)</td>
</tr>
<tr>
<td>6/60 – 1/60</td>
<td>176 (40%)</td>
<td>90 (20.40%)</td>
</tr>
<tr>
<td>CF</td>
<td>265 (60%)</td>
<td>70 (15.87%)</td>
</tr>
<tr>
<td>NPL</td>
<td>0</td>
<td>1 (2%)</td>
</tr>
<tr>
<td>CF: counting finger</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPL: No perception of light</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table III: Post-operative complications (N-441)

<table>
<thead>
<tr>
<th>Complications</th>
<th>No of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astigmatism</td>
<td>130 (29.47%)</td>
</tr>
<tr>
<td>Graft rejection</td>
<td>38 (8.61%)</td>
</tr>
<tr>
<td>Graft failure</td>
<td>27 (6.12%)</td>
</tr>
<tr>
<td>Secondary glaucoma</td>
<td>23 (5.21%)</td>
</tr>
<tr>
<td>Hyphaema</td>
<td>07 (1.5)</td>
</tr>
<tr>
<td>TASS</td>
<td>05 (1.337%)</td>
</tr>
<tr>
<td>Post: sub capsular cataract</td>
<td>05 (1.337%)</td>
</tr>
<tr>
<td>Paretic pupil</td>
<td>03 (0.68%)</td>
</tr>
<tr>
<td>TASS: Toxic anterior segment syndrome</td>
<td></td>
</tr>
</tbody>
</table>

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Role of Amniotic Membrane in Ocular Surface Diseases

Afzal Qadir1, Mir Zaman2, Irfanullah Shah3, Zakir Hussain4, Inayat-ullah Khan5

ABSTRACT

Objectives: Efficacy of amniotic membrane in ocular surface diseases.

Material and Methods: This interventional case series was conducted in the Department of Khyber Institute of Ophthalmic Medical Sciences (KIOMS) Hayatabad Medical Complex, Hayatabad, Peshawar from January 2009 to January 2011. In this study 186 patients with various diseases of ocular surface were treated with amniotic membrane transplantation over a period of two years. Surgeries were performed as needed under local and general anesthesia, amniotic membrane was used as a therapeutic contact lens. Significant improvement in sign and symptom, like ocular pain, irritation, photophobia, discharge, and visual acuity was noted.

Results: Out of 186 patients 70% were male and 30% were female. In ocular surface disorder, 50 patients were pterygium, 40 patients with infectious keratitis, 30 patients with shield ulcer, 15 patients with impending perforation, 12 patients with band keratopathy, 08 patients with bullous keratopathy, 08 patients with penetrating keratoplasty, 06 patients with chemical injury, 06 patients with recurrent corneal epithelium erosion, 04 patients with neurotrophic keratitis, 02 patients with mooren ulcer, 02 patients with stevens johnson syndrome, 02 patients with filtering bleb and 01 patient with conjunctival squamous cell carcinoma.

Conclusion: Amniotic membrane is a safe, effective and useful treatment for the treatment of ocular surface disorders.

Keywords: Amniotic membrane, ocular surface diseases.

INTRODUCTION:

The normal ocular surface is covered by epithelial cells which can be damaged by certain systemic inflammatory diseases,1 primary ocular diseases, and trauma resulting in the breakdown of ocular surface.2 If the normal epithelialization process fails, ocular surface defect becomes chronic. Chronic inflammation leads to neovascularization, corneal scarring, opacification, corneal thinning, corneal melting and possible corneal perforation. Traditional treatments for ocular surface disorders include correcting underlying pathology, suppressing inflammation and promoting healing process. Currently, artificial tears, lubricants, fibronectins,3,4 growth factors,5 and substance P6 are used. However, if defect persists and stromal thinning develops, more invasive surgical options like tissue adhesive,7 bandage contact lens,8 conjunctival flap,9 penetrating keratoplasty, Boston keratoprosthesis and tarsorrhaphy can be performed.10 But these treatments have their own complications. In this background amniotic membrane can be considered as an option for treating the ocular surface defects.3,4

In 1910, Davis reported the use of fetal membrane in skin transplantation for the first time.11 Amniotic membrane transplantation in ophthalmology was reported by De Roth in 1914 who achieved partial success in treatment of conjunctival epithelial defects.12 There was very little information available in ophthalmic literature until the study by Kim and Tseng in 1995 who used amniotic membrane transplantation for ocular surface reconstruction of severely damaged cornea in rabbit model. Since that experimental study, amniotic membrane transplantation has been used for persistent corneal epithelial defects, neurotrophic corneal ulcers, conjunctival surface reconstruction, bullous keratopathy, chemical or thermal burns and in patients of Steven-Johnson syndrome.13-15 Ocular surface disorders are a common problem and current management is not satisfactory. Amniotic membrane transplantation has shown better results in treating these disorders. In Pakistan, a very little work has been done so far in this regard. So, I scientifically studied this new technique in the local setup.

MATERIAL AND METHODS:

This interventional case series was conducted in the Department of Khyber Institute of Ophthalmic Medical Sciences (KIOMS), Hayatabad Medical Complex, Hayatabad Peshawar from January 2009 to January 2011. In this study evaluation of over a period of two years of 186 patients were included. Age ranging from 3 years to 70 years. Patients with globe perforation...
were excluded from this study. Informed written consent was taken. Detail ocular and systemic history and examination were performed to get proper diagnosis.

**Preparation of Amniotic membrane:**

Amniotic membrane was obtained from prospective donors undergoing elective Caesarean section, who were negative for communicable diseases including HIV, hepatitis and syphilis. Different protocols exist for the processing and storage. We used protocol described by Kim et al. According to which placenta is cleaned and stored with balanced salt solution containing a cocktail of antibiotics (Table 1) under sterile conditions.

**Surgical Techniques**

I. **Inlay or graft technique:** When Amniotic membrane is tailored to the size of the defect, is meant to act as a scaffold for the epithelial cells and which then merges with the host tissue, it is referred to as a graft. Amniotic membrane was secured with its basement membrane or epithelial side up to allow migration of the surrounding epithelial cells on the membrane.

II. **Overlay or patch technique:** When the Amniotic membrane is used akin to a biological contact lens in order to protect the healing surface defect beneath; it is referred to as a patch. A patch also reduces inflammation by its barrier effect against the chemical mediators from the tear film. When used as patch the membrane is secured with its basement membrane is removed.

III. **Filling-in or layered technique:** In this technique the entire depth of an ulcer crater is filled with small pieces of AM trimmed to the size of the defect. A larger graft is sutured to the edges of the defect in an inlay fashion and an additional patch may help in preserving the deeper layers for a longer duration. Preoperative evaluation was applied to all patients with special attention given to patient’s symptoms with respect to pain, photophobia and best corrected visual acuity. Follow up was observed at first post-operative day, 1st week, 2nd week and 1 month for best corrected visual acuity, ocular symptoms (pain and photophobia) and complications. The data was analyzed by SPSS version 10.00, the variables of outcome measures (pain, photophobia, best corrected visual acuity, graft uptake) was presented as proportions and ratios. The variables of outcome were compared with some of variables of demography. Since this study was a quasi-experimental, no test of significance was necessary.

**RESULTS:**

Of the 186 patients of different ocular surface disorders included in this study, 70% were males and 30% were females of ocular surface disorders of various types. The most common ocular surface disorder 50 (26.88%) patients were pterygium, followed by 40 (21.50%) patients of infectious keratitis, 30 (16.12%) patients of shield ulcer, 15 (8.06%) patients with impending perforation, 12 (6.45%) patients with band keratopathy, 08 (4.30%) patients were bullous keratopathy, 08 (4.30%) patients with penetrating keratoplasty, 06 (3.22%) patients with chemical injury, 06 (3.22%) patients with recurrent corneal epithelium erosion, 04 (2.15%) patients with neurotrophic keratitis, 02 (1.075%) patients with mooren ulcer, 02 (1.075%) patients with stevens johnson syndrome, 02 (1.075%) patients with filtering bleb, and 01 (0.53%) patient with conjunctival squamous cell carcinoma.

The ocular surface defects were present in both eyes of (40.0%) cases. (53.3%) cases had these defects in right eye, while (6.7%) cases left eye was involved out of total 186 cases. Ocular pain was one of the most important variable of study. It was recorded on the pain scale from grade 0 – 4 as described by the patient. 30 (16.12%) patients did not complain any pain (Grade 0). 40 (21.50%) cases had mild pain (grade 1). 12 (6.45%) cases were having moderate pain (grade 2). 08 (4.30%) patients described severe pain. After one month of amniotic membrane transplantation, most of the patients 160 (86.02%) were having no pain (grade 0), only 6 (3.22%) and 4 (2.15%) patients described mild (grade 1) and moderate (grade 2) pain. No patient described grade 3 and 4 level of pain. 60 (32.25%) of the patients were photophobic, rest of them were not complaining of photophobia. A remarkable improvement was noted in this regard. At one month after surgery, 180 (96.77%) patients did not complain of photophobia and only 6 (3.22%) cases were still complaining of photophobia. There was an improvement of best corrected visual acuity noted, after one month of surgery 80 (43.01%) had best corrected visual acuity of 6/12, while 30 (16.12%) case had 6/18 and 26 (13.97%) patients were having visual acuity 6/24. 50 (26.88%) were still having best corrected visual acuity of 6/60 or less.

**Table 1:** Contents and concentrations of antibiotics solution used for cleaning and preservation of amniotic membrane.

<table>
<thead>
<tr>
<th>Antimicrobial Agent</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penicillin</td>
<td>50 mg/ml</td>
</tr>
<tr>
<td>Streptomycin</td>
<td>50 lg/ml</td>
</tr>
<tr>
<td>Neomycin</td>
<td>100 mg/ml</td>
</tr>
<tr>
<td>Amphotericin B</td>
<td>2.5 mg/ml</td>
</tr>
</tbody>
</table>
Table 2: Causes of ocular surface diseases (N 186)

<table>
<thead>
<tr>
<th>Ocular surface diseases</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pterygium</td>
<td>50 (26.88%)</td>
</tr>
<tr>
<td>Infectious keratitis</td>
<td>40 (21.50%)</td>
</tr>
<tr>
<td>Shield ulcer</td>
<td>30 (16.12%)</td>
</tr>
<tr>
<td>Impending perforation</td>
<td>15 (8.06%)</td>
</tr>
<tr>
<td>Band keratopathy</td>
<td>12 (6.45%)</td>
</tr>
<tr>
<td>Bullous keratopathy</td>
<td>08 (4.30%)</td>
</tr>
<tr>
<td>Penetrating keratoplasty</td>
<td>08 (4.30%)</td>
</tr>
<tr>
<td>Chemical injury</td>
<td>06 (3.22%)</td>
</tr>
<tr>
<td>Recurrent corneal epithelial erosion</td>
<td>06 (3.22%)</td>
</tr>
<tr>
<td>Neurotrophic keratitis,</td>
<td>04 (2.15%)</td>
</tr>
<tr>
<td>Mooren ulcer</td>
<td>02 (1.075%)</td>
</tr>
<tr>
<td>Stevens johnson syndrome</td>
<td>02 (1.075%)</td>
</tr>
<tr>
<td>Filtering bleb</td>
<td>02 (1.075%)</td>
</tr>
<tr>
<td>Conjunctival squamous cell carcinoma</td>
<td>01 (0.53%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>186</strong></td>
</tr>
</tbody>
</table>

**DISCUSSION**

Ocular surface disorders are a common problem that presents not only with decrease of vision but also pain and photophobia. Unfortunately, so far its medical or surgical treatment has not shown satisfactory results. Amniotic membrane that had been used for other purposes like biological dressing to cover the open wounds and skin transplantation, have also shown good results in ocular surface defects healing and thus relieving the symptoms of ocular irritation. Human amniotic membrane is derived from the fetal membranes and is loosely attached to the chorion. It is composed of three layers: a single epithelial layer, thick basement membrane, and avascular stroma. Human amniotic membrane has been shown to contain collagen types III and V. It also contains collagen types IV and VII similar to corneal epithelial basement membrane as well as fibronectin and laminin. Additionally, it contains fibroblast and other growth factors. Amnion prevents inflammatory cell infiltration and reduces apoptosis in keratocytes after transplantation onto the corneal surface. Due to all these properties amniotic membrane transplantation is found to be an important tool for reconstruction of ocular surface disorders.

Reduction in symptoms of ocular irritation that includes pain and photophobia was 90% in our study which is comparable to the other studies. Increased comfort level, improved the quality of life of the patients. There was no remarkable improvement in best corrected visual acuity observed in our study. The final visual acuity less than 6/60 was recorded in 67% of cases in our study which was quite similar to study by Prabhasawat P, Tesavibul N who also observed the similar ratio in their study. However increased comfort level improved the quality of life of these patients and visual acuity was not the issue in these patients. Failure was noted in 3 (10%) cases in our study. This was due to graft necrosis, active infection and intractable corneal perforation. This failure points out the limitations of AMT in treating ocular surface disorders.

The possible causes of failure could be, continuous tissue destruction compounded with active infection underneath the graft, had retarded healing and secondly there might have been inadequate limbal stem cells and intact sensory innervations which are mandatory for repairing and maintaining ocular surface integrity. Thirdly normal keratocytes from adjacent area might be important in restoring stromal integrity after AMT. The results of study showed that amniotic membrane transplantation is effective in ocular surface disorders when all other existing methods of management fail.

**CONCLUSION**

Amniotic membrane transplantation appears to be a useful method to alleviate symptoms of ocular surface irritation like pain, photophobia and lacrimation caused by the ocular surface disorders. It does not only heal the corneal surface defect but also helps in preserving the globe. The future studies are required for further elaboration of usefulness of this tissue.

**REFERENCE**


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Are you going to Lahore Ophthalmmo, Yes! Certainly, I can’t miss “Taka Tak”.

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Prevalence of Glaucoma in Low Myopic VS High Myopic Patients: (A Study of 300 Cases)

Mohammad Alam FCPS¹, Jamal Hussain², Awalia Jan³

ABSTRACT:
Objective: To compare the prevalence of glaucoma in low myopic VS high myopic patients.

Materials and Methods: This comparative study of four years duration was conducted in Eye Care Centre Karak from January 2008 to December 2011. Total 300 patients with myopic refractive error were selected comprising of 171 male and 129 female with age ranging from 15 years to 50 years. Informed consents were taken. They were divided into two groups A & B both had 150 patients. Group A patient had spherical equivalent of myopia from 0.5D- 4.0 diopter spherical while group B patients had spherical equivalent of myopia more than 4.0 diopter spherical. Intraocular pressure was checked with applanantion Tonometer. Perimetry was done by confrontation method in advanced stage while in initial stage by Humphrey Visual Field Analyser. Fundoscopy with dilated pupils was done with direct and indirect ophthalmoscope and indirect slit lamp bimicroscopy. Myopic error was checked with retinoscope and auto-refractometer.

Results: In Group A 5 (3.33%) patients had high intraocular pressure with glaucomatous cup-disc and visual fields changes while in Group B 7(4.66%) patients had glaucomatous cup disc and visual fields changes with high Intraocular pressure.

Conclusion: Glaucoma has association with myopia and the prevalence increases with increase in refractive error.

Abbreviation: Intraocular pressure (IOP) visual filed (VF) Refractive error (R.E) Primary Open-Angle Glaucoma (POAG). Diopter Spherical (DS).

INTRODUCTION:
Myopia is a major refractive error. It has association with other ocular morbidities like degenerative changes in fundus like macular hole and even retinal detachment. One of the important associations of Myopia is with POAG. Myopic association with POAG has been documented for many decades in numerous studies. Some studies have reported high frequency of Myopia in young patients presenting with POAG. Chihara, E, study has reported the association of POAG only in patients with high Myopia. In some large case control studies myopia was found to have strong association with ocular hypertension.

In Barbados Eye Study and Blue Mountain Eye Study it was concluded that Glaucomatous optic nerve damage was more in myopic patients as compared to hyperopic. These finding were in consonance with hospital based studies in which axial Myopia had been reported to be a risk factor for Glaucomatous optic neuropathy.

Myopic patients usually go unnoticed while having association with POAG. This negligence later on may result in advanced stage of cupped disc being irreversible. Histopathological and clinical investigation have shown that optic nerve head appearance varies between patients with high Myopia and with patients of low to moderate Myopia. This comparative study is based on the prevalence of POAG in patient with low Myopia verses high Myopia.

MATERIALS AND METHODS:
This comparative study of prevalence of POAG with low myopia verses high myopia was conducted in eye care center Karak from January 2008 to December 2011 spanning four years duration. Total three hundred (300) patients after informed consent were included in this study comprising of 171 male and 129 female (Table I). The age range was from 15-50 years. They were divided into two groups A and B both have 150 patients. Myopic RE was taken as spherical equivalent. RE was measured with retinoscope and auto refractor. Group A patients had Myopic RE from 0.5- 4 DS while group B patients had Myopic RE more than 4 DS (Table II).

Angle of anterior chamber of the patients was examined with van Herrick method with slit lamp. IOP was checked with applanantion Tonometer. Perimetry
was done in Tertiary level hospital by visual field analyser as well as by confrontation method in advanced stage of POAG. Pupils were dilated with Tropicamide Eye drop and Fundoscopy was done with direct/indirect ophthalmoscope and indirect slit lamp bimicroscopy.

**Inclusive criteria:**
1. Myopic patients
2. patients with high IOP
3. patients with cup disc changes
4. patients with visual field changes

**Exclusive criteria:**
1. Aphakic / Pseudophakic patients
2. Traumatic patients
3. Patients with high IOP but no cup disc and visual field changes.

**RESULTS:**
In group A with low Myopic RE 5(3.33%) patients had POAG while in group B with high Myopic RE 7(4.66%) patients had POAG (Table III). As far as the gender is concerned in group A 3(60%) patients were male and 2(40%) were female who had POAG associated with Myopia. In group B 5(71.42%) patients were male while 2(28.6%) were female who had POAG associated with Myopic RE (Table IV)

**DISCUSSION:**
According to this study prevalence of POAG was more in high Myopic than low Myopic patients which suggests high glaucoma susceptibility in eyes with marked myopia.

There are multiple studies which have shown that POAG does have association with Myopia. Study of Paul Mitchell, Flever Houirhan et al has reported association POAG with myopia. This study revealed 4.2% patients had POAG with low myopia compared to 4.4% patients with moderate to high myopia which is nearly comparable to our study. Many case control and clinic based studies have reported a relationship between POAG and myopia. No previous population based studies have searched the association in detail while taking into account the effects of other known Glaucoma risk factors. Confirmation that myopia is a frequent risk factor for Glaucoma should help to identify this group whose participants need earlier and regular ophthalmic screening and follow up.

Study of Liang XU, Yaxing Wang, Shuang Wang et al has reported the association of Glaucoma with high myopia. This study has shown that hypermetropic and emmetropic population had no changes in the cup disc while Glaucomatous optic neuropathy was more in high myopic patients as well as prevalence of Glaucoma had higher incidence.

The Blue Mountain Eye Study has reported prevalence of glaucoma ranged from 1.5% in emmetropic to 4.4% in myopia. The Barbados Eye Study revealed that myopia increases the odds of having Glaucoma while hypermetropia has decreased the odds for Glaucoma.

Our study is supported by another International Study of Malmo Eye Survey based on early manifest Glaucoma Trail over a large number of population. This study has shown strong association of Glaucoma with myopia. Chihiro Mayama, Yasoyaki Suzuki, Makato Arai et al had reported in their study that high myopia constitutes a threat to visual field in advanced Glaucoma.

Aaron A, Kuzin, Rohit varma et al study has demonstrated that prevalence of glaucoma was 8.1% in myopic patients. This ratio is higher than our study results. The reasons may be due to sample size and level of myopia. As evident from all the international studies prevalence of Glaucoma increases with increase in myopic error. However the Beaver Dam Eye Study did not show the pattern of increasing severity of myopia. These differences could be explained by racial variations, difference in definition of Glaucoma, or in analytical approaches.
Study of Nelsa I, Loyo, Berrios, Joseph et al has reported the evidence of increase risk of POAG among myopic patients is stronger for moderate and high myopia and not for mild myopia. The prevalence of POAG with myopia has been supported by population based cross-sectional epidemiologic study conducted by Yosuuki Suzuki, Aiko Iwase; Makato Arai et al. This study has proved that myopia is a significant risk factor for POAG.

**CONCLUSION:**

This study has shown that primary open glaucoma is associated with myopia. If myopia has been only treated, it means that some important ocular co-morbidities like glaucoma has been left as such untreated. So all the myopic patients must be screened for glaucoma.

**REFERENCES:**

INTRODUCTION:

The arcuate field defects, produced due to selective destruction of the arcuate fibers, are a pathognomonic feature of both high-tension (HTG) and normal-tension glaucoma (NTG), the statistically normal range of intraocular pressure is 10 to 21mmHg. Although these arcuate field defects were discovered more than 100 years ago by Bjerrum and Ronnie, we still have not come to a consensus as to why they are produced. The arcuate field defects are so sharply defined, it is as though the arcuate fibers have been deliberately excised with a pair of scissors. There are several theories, ranging from: the undue sensitivity of the arcuate fibers to raised intraocular pressure (IOP), to their increased vulnerability due to larger size holes in the region of arcuate fibers in the lamina cribrosa.1 However, none of these theories satisfactorily explain the selective destruction of arcuate fibers in the early stages of glaucoma. This article focuses on this controversial subject as this may be the crucial key to finding the true pathogenesis of glaucoma.

Visual field defects in glaucoma are produced in a specific sequence; indicating that the nerve fibers are being destroyed methodically and not haphazardly. The most peripheral temporal fibers are destroyed first, resulting in the loss of most peripheral nasal field. However, the very early nasal field loss has little diagnostic value because of normal variation in the extent of peripheral fields. Moreover, there are hardly any noticeable glaucomatous changes occurring in the optic disc at this early stage. However, when the nasal field loss extends inward and produces a horizontal nasal step, this feature becomes diagnostic of glaucoma. This initial stage is followed by production of isolated scotomas in the 10 to 20 degrees of the paracentral region which coalesce to form superior and inferior arcuate field defects. Both arcuate field defects combined together are called ring scotoma.

Before we discuss as to why the nerve fibers in glaucoma are being destroyed in a specific sequence, it is imperative to mention the arrangement of the nerve fibers in the retina and optic disc. There are about one million nerve fibers originating from the retinal ganglion cells (RGC) which leave the eye ball through meshwork of the lamina cribrosa and form the optic disc.

There are four main aspects in which the nerve fibers are arranged in the retina and in the optic disc. First, the nerve fibers in the retina are arranged in layers superficial to deep. Second, the most central vision fibers originate closest to the disc lie most superficial (closest to vitreous) and exit from the most central part of the disc. In contrast, the most peripheral fibers originate from the most distant retina or farthest from the optic disc lie deepest (closest to sclera) and exit closest to the edge of the scleral opening. Figure 1 Third, the nerve fibers originating from the nasal retina proceed directly to the nasal part of the optic disc. However, the situation is different in the temporal retina because of the presence of the macular fibers. The fibers originating from the nasal aspect of macular area proceed directly to the central temporal part of the disc. The fibers originating from the temporal macular and peripheral retina have to arch above and below the macular fibers to reach the superior and inferior poles of the optic disc respectively, and hence are known as arcuate fibers. Figure 2 Fourth, the nerve fibers of the superior and inferior hemifield are separated by horizontal meridian and do not cross over to the opposite hemifield.

Based on the glaucomatous visual field defects, the nerve fibers, invariably, are being destroyed in a specific sequence and an orderly fashion, yet never haphazardly in glaucoma. This important feature of orderly destruction of the nerve fibers will be the focus of our presentation in finding the pathogenesis of
arcuate field defects in glaucoma.

DISCUSSION:

By reviewing the literature, the subject of pathogenesis of glaucomatous field loss appears quite controversial. There are two main theories: mechanical and vascular, which were put forward 150 years ago, the time chronic glaucoma was given a separate entity. According to mechanical theory, the raised IOP directly compresses the nerve fibers or causes posterior bowing of the lamina cribrosa resulting in distortion of the laminar holes. This in turn causes interruption of the axoplasmic flow resulting in the death of RGCs.

The second school of thought, vascular theory, suggests that the raised IOP directly compresses the blood vessels resulting in ischemia and thus death of the RGCs/nerve fibers. Some believe that both mechanical and ischemic events are occurring in glaucoma.

Duke-Elder, Henkind, Harrington, and Hayreh were proponents of the vascular theory. Henkind suggested the occlusion of radial peripapillary capillaries as the cause of selective destruction of the arcuate fibers. It has also been suggested that glaucoma is due to varying degree of sensitivity of the nerve fibers to IOP: the ocular hypertension cases would be those in whom the nerve fibers are the most resistant whereas normal-tension glaucoma subjects will have the nerve fibers least resistant to IOP. Neuro-degeneration is also being implicated in glaucoma akin to Alzheimer’s or Parkinson’s disease.

There was very comprehensive discussion on “Pathogenesis of Visual Field in Glaucoma” by Edward Maumenee, published in Controversy in Ophthalmology. Maumenee had challenged the direct role of both mechanical and vascular theory for the production of the glaucomatous field defects. Maumenee argued against the vascular theory because of normal electroretinogram and fluorescein angiography in glaucoma, which he expected to be abnormal if vascular theory was valid. Maumenee remarked that both mechanical and vascular theory were not convincing and concluded “the exact cause of loss of visual field in glaucoma is not known at present time”. This well-reasoned conclusion was stated almost 35 years ago, to our dismay, it still holds true today. Now we would discuss the orderly destruction of nerve fibers in view of present theories of glaucoma.

Can the nerve fibers be destroyed in an orderly fashion, if cupping of the optic disc is occurring?

The term ‘cupping’, given by Heinrich Muller in 1856, implies that the pathology starts from the central part of the disc and extends peripherally. However, according to the distribution of nerve fibers in retina, the fibers for the central vision originate closer to the optic disc lie superficial (closer to the vitreous) and exit from the central part of the disc. Therefore, if cupping was truly occurring then the central vision fibers should have been destroyed first and peripheral fibers at the last, but in actuality, the opposite is occurring in glaucoma. Moreover, if cupping was taking place, there should have been immediate blindness due loss of central vision fibers in the earliest stages of glaucoma. Therefore, keeping in view the distribution of the nerve fibers in the retina/optic disc and the glaucomatous field defects, the cupping theory appears to be invalid and mistakenly given 150 years ago.

Can the nerve fibers be destroyed in an orderly fashion due to direct role of raised IOP?

It has been postulated over 150 years ago that retinal nerve fibers are destroyed either due to direct effect or via ischemia induced by direct compression of the blood vessels by raised IOP.

Arguments against the direct role of IOP: how is it possible that raised IOP, acting directly, will always destroy the peripheral fibers first, followed by paracentral arcuate fibers and ending with the central fibers and IOP will never destroy the nerve fibers randomly?

It is also hypothesized that raised IOP causes posterior bowing of the lamina cribrosa, resulting in distortion of its holes and causing the interruption of the axoplasmic flow leading to the death of the RGCs. Arguments against the posterior bowing of the lamina: the central vision fibers being located at the apex of the bowed lamina, should be destroyed first not the peripheral fibers.

Moreover, if the bowing of the lamina was occurring due to high IOP then how can we explain the bowing of the lamina occurring in NTG in which the IOP is within normal range. It appears unlikely that any pathology occurring within the holes of the lamina cribrosa can be as precise as to result in an orderly destruction of nerve fibers. In view of the above rationale, it appears unlikely that bowing of the lamina would result in selective destruction of arcuate fibers in the early stages of glaucoma.

Can the nerve fibers be destroyed in an orderly fashion if glaucoma is a neurodegenerative disease?

Glaucoma is implicated as a neurodegenerative disease akin to Parkinson’s disease, Alzheimer’s or Amyotrophic Lateral Sclerosis (ALS). Arguments against glaucoma being a neurodegenerative disease will also be based on the orderly destruction of nerve fibers occurring in glaucoma.

The random degeneration of the neurons is a characteristic feature of a neurodegenerative disease, therefore the course of a neurodegenerative disease varies in each individual. Therefore, it would be
unlikely that neurodegeneration, in glaucoma, will always start first with those RGCs, which serve the peripheral vision and not occur randomly. Glaucoma is considered a neurodegenerative disease due to unexplained death of neurons in the lateral geniculate nucleus (LGN) occurring concurrently with the death of retinal ganglion cells. The reason for their simultaneous death will be discussed later in this presentation under section of paradigm shift.

Other theories for the production of the arcuate field defects include occlusion of radial peripapillary capillaries because of their arcuate shaped blood vessels distribution. It would be an unlikely scenario that occlusion of the radial peripapillary capillaries could produce ischemia so precise and well defined that it would cause an orderly destruction of nerve fibers in glaucoma. It has also been mentioned that glaucoma is due to varying degree of sensitivity of the nerve fibers to IOP; ocular hypertension subjects having the most resistant nerve fibers to IOP whereas the NTG subjects the least resistant to IOP. If the aforementioned is true, then someone born with undue sensitivity of the nerve fibers to IOP should develop NTG in early childhood, not after the age 50 or more. It would be difficult to convince ourselves that subjects although born with variable sensitivity of the nerve fibers yet would have an orderly destruction of nerve fibers starting with the peripheral fibers in glaucoma. If the nerve fibers are being destroyed in an orderly fashion, then we should expect the mechanism causing their destruction to be an orderly as well. In fact, the raised IOP, ischemia, neurodegeneration, undue sensitivity or any pathology acting directly on the RGCs or nerve fibers cannot result in the orderly destruction of the nerve fibers in glaucoma.

Then, why are the nerve fibers being destroyed in an orderly fashion in glaucoma?

In order to answer above intriguing question, we will have to change the current ‘cupping disc’ paradigm with ‘sinking disc’ - a paradigm shift. We hypothesize that the optic disc may be sinking, not cupping in glaucoma.8,9

PARADIGM SHIFT

Due to sinking of the disc, the prelaminar nerve fibers, prior to their entry in the lamina cribrosa, are being stretched as one end is attached to the RGC and the other end anchored in the sinking optic disc and ultimately severed against the scleral edge. In other words the optic disc may be herniating in the scleral canal - a mechanical problem. If this is true then the nerve fibers are being severed, not atrophied in glaucoma. Severing of the nerve fibers appears to be a unique phenomenon occurring in the glaucomatous disc. Glaucoma may not be an optic disc neuropathy but an axotomy.

Now we will discuss if the orderly production of visual field defects in glaucoma can be produced in context of severance of the nerve fibers. Since the peripheral nerve fibers lie deeper and exit closer to the scleral edge, the peripheral fibers would be the first to be affected and severed if the sinking of the disc is occurring and this is shown by peripheral field loss in early stages of glaucoma. As the peripheral fibers are being severed, the central fibers will move towards the periphery to occupy the vacant space. Figure 3 This movement of the central fibers to the periphery will break or enlarge the physiological cup which may be mistaken as true cup enlargement, known as cupping. Severance of the nerve fibers may explain the death of the neurons in LGN due to Wallerian degeneration, whereas the retrograde degeneration would result in the death of RGCs. I believe aforementioned concurrent death of the neurons in the LGN and of RGCs may be the reason the glaucoma is considered a neurodegenerative disease.

Returning to our main question: why are the arcuate fibers being selectively destroyed in glaucoma?

Due to inherent temporal tilt of the optic disc, the entire group of temporal fibers (macular, superior and inferior arcuate) are being stretched and severed. Figure 4 However, the superior and inferior arcuate fibers being fewer in number compared to the macular fibers will be depleted earlier, resulting in arcuate field defects/ring scotoma. Figure 5 During this process of sporadic depletion, there would initially be isolated scotomas in the paracentral area, but as glaucoma progresses and all the arcuate nerve fibers are severed and depleted, these isolated scotomas will coalesce to form complete arcuate field defects. The severing of the nerve fibers may explain the selective destruction of the arcuate fibers in glaucoma. Therefore, the severance, not the degeneration/atrophy of the nerve fibers appears to be involved in the production of the arcuate field defects. It would be an unlikely event that any pathology could result in atrophy only of the arcuate fibers out of one million densely packed nerve fibers in a 1.5 mm optic disc. Sinking of the disc will become self-propagated due to severance of nerve fibers, which also provide anchorage to the optic disc as roots do to a tree. Sinking of the disc will continue until all the nerve fibers are severed in an orderly sequence from the peripheral to central fibers. Figure 3 Therefore, the sinking of the disc and severing of the nerve fibers can explain the orderly visual field loss starting with the peripheral and ending with the central field in glaucoma.

Since we have proposed, the nerve fibers are being severed in glaucoma: do we have any evidence?
Figure 1. Normal Disc: Arrangement of nerve fibers in retina and optic disc. The most peripheral fibers (5) originate farthest from the optic disc, lie deep, closest to the sclera and exit closest to the scleral edge. Whereas, the most central fibers (1) originate closest to the disc, lie superficial, closest to the vitreous and exit from most central part of the disc.

Figure 2. Arrangement of nerve fibers in the retina and optic disc. The arcuate fibers, arch above and below the macular fibers, are selectively destroyed in the early stages of glaucoma. The arcuate fibers, arch above and below the macular fibers, are selectively destroyed in the early stages of glaucoma.

Figure 3. Due to sinking of the disc, the most peripheral and deepest prelaminar fibers (5) are stretched and severed against the scleral edge (red arrows) first, and ending with the most central fibers (1). Thus, the central fibers move to be periphery (black arrows) resulting in enlargement of the original cup, known as cupping.

Figure 4. Due to temporal sinking, all of the temporal fibers (macular, superior and inferior arcuate) are being stretched and severed. However, the arcuate fibers being fewer in number, compared to macular fibers will be depleted earlier, resulting in arcuate field defects as shown in figure 5.

Although we may never witness the actual process of severing of the nerve fibers, we may infer this fact by deductive reasoning of the changes occurring in a glaucomatous disc. The continuous severing of the nerve fibers is supported by the phenomenon of progressive thinning of the RNFL as observed on optical coherence tomography (OCT). Moreover, the end-stage histology of glaucomatous disc resembles an empty bean-pot. Interestingly, the bean-pot appears quite huge compared to the size of original disc. Is this large empty bean-pot really a deeply cupped disc (lamina)? Is the lamina so inflatable that it has ballooned into a large bean-pot? If not, where did the lamina and nerve fibers go?
In order to answer the aforementioned questions, we will compare the histology of both glaucomatous disc and of the non-glaucomatous atrophic disc such as due to multiple sclerosis. The histology of end-stage glaucomatous disc reveals a large crater (bean-pot), with an entrance appearing to be the scleral opening and its belly formed of dura mater, not the lamina cribrosa.

Figure 6 In contrast, the histology of a flat atrophic disc reveals shrunken and collapsed nerve fibers, not an empty bean-pot. Figure 7 Moreover, the non-glaucomatous atrophic disc is flat, there is neither sloping/kinking of the blood vessels at the disc margin nor excavation of the disc occurring as in the glaucomatous discs.
The flat atrophic discs are not sinking in the scleral canal, therefore no severance of the nerve fibers occurring and thus no excavation in the flat atrophic disc. Therefore, distinctly different pathological process are taking place in the flat atrophic discs and in the glaucomatous discs. In the flat atrophic disc, the nerve fibers are being atrophied whereas in glaucomatous disc the nerve fibres are being severed. The severance of the nerve fibres appears to be the unique feature of glaucoma. End-stage glaucomatous disc is not a deeply cupped disc, but a leftover empty crater after the severance of all of the nerve fibers and the freed lamina may be lying at the bottom. The end-stage glaucomatous disc resembling an empty crater can only be explained by severance, not due to atrophy of the nerve fibers.

**Do we have any evidence of sinking disc?**

I believe we do. **First**, the photographs of the glaucomatous optic discs vividly reveal sloping and kinking of the blood vessels at the disc margin prior to any change in the contour of the physiological cup. This suggests that the optic disc may be sinking, not cupping in glaucoma. The physiological cup may not be truly enlarging, but instead, disintegrating and excavating due to severance of the nerve fibers. **Second**, the new enhanced imaging technique of the optic disc (EDI-SD-OCT) has enabled us to visualize the deeper structures in the scleral canal well beyond the entire width of the lamina cribrosa which was previously not possible with standard SD-OCT. Therefore, EDI technique has opened a new chapter and is providing us very valuable information of the glaucomatous disc. EDI of the glaucomatous optic disc, in vivo, has shown the posterior migration of the lamina cribrosa as far back as pia mater or in other words total sliding outward of the lamina from the scleral opening, from the very early stages of glaucoma.10-13 This is very significant discovery as it suggests that lamina (optic disc) is detachable from the scleral wall and is able to slide posteriorly (sink) in the scleral canal. EDI findings support the phenomenon of sinking, not cupping of the disc. If true, then chronic glaucoma may be a mechanical problem, in fact, a herniation of the disc.

**Why is the optic disc sinking in both HTG and NTG?**

We hypothesize that the collagenous border tissue of Elschnig lying between the lamina cribrosa and the scleral edge may be the primary site of pathology, not the lamina cribrosa itself. Border tissue acts like an ‘O’ ring seal which keeps the optic disc firmly anchored in the scleral opening. If the border tissue atrophies, the optic disc will start sinking in the scleral canal. Why would the border tissue atrophy in both HTG and NTG? It is a complex and multifactorial subject. **First**, the interaction between the circulation of the border tissue and IOP. **Second**, the structural integrity of the border tissue itself, inherent or acquired. The border tissue is supplied exclusively by the short posterior ciliary arteries, a weaker pressure compared to the central retinal artery, which unfortunately, does not participate in the blood supply of the border tissue.14

The systemic ciliary pressure and IOP are opposing forces. Normally the ciliary pressure of the border tissue should be higher than the IOP for its good perfusion and healthy maintenance. However, if either the IOP becomes higher than the ciliary circulatory pressure due to an ocular disease or the ciliary pressure supplying the border tissue becomes lower than IOP, due to some systemic problems like chronic hypotension then the IOP will take the upper hand and will compress the circulation of the border tissue, resulting in chronic ischemia and its atrophy. In the latter scenario, if the ciliary pressure becomes lower than any normal range IOP level then that normal range IOP level will act as a higher IOP for that subject, thus NTG will result. **Figure 8** Therefore it is still the IOP, whether within or above the statistically normal range, appears to be the culprit in both HTG and NTG. Moreover, it is not only the IOP level important, but also the compromised oxygen carrying capacity of the blood which may also cause chronic hypoxia and atrophy of the border tissue. This may explain the higher incidence of NTG in cases of long-term smokers and those with sleep apnea. Therefore, the normal-tension glaucoma may be a systemic disease.

In addition to circulation we may have to consider the structural integrity of the border tissue. If someone is endowed with strong border tissue then that particular subject may tolerate the circulatory imbalance for a longer period compared to someone who has weak border tissue such as in high myopia or various collagen tissue disorders. Keeping all these factors in view, the pathogenesis of atrophy of the border tissue becomes multifactorial.

**CONCLUSION:**

In fact, the sinking of the optic disc is a herniation in the scleral canal- a mechanical problem. Due to sinking of the optic disc, the nerve fibers are stretched and ultimately severed at the scleral edge. The severance of the nerve fibers can explain the selective destruction of the arcuate fibers in the early stages of glaucoma. The sinking of the disc and severance of the nerve fibers can explain the orderly destruction of the nerve fibers, starting with the peripheral and ending with the central fibers. Glaucoma may not be an optic disc neuropathy but an optic disc axotomy.

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INTRODUCTION

Glaucoma is second only to cataract among visual disorders, but it is a major cause of worldwide irreversible blindness. Bilateral blindness will be present in 5.9 million people with open-angle glaucoma and 5.3 million people with angle-closure glaucoma in 2020.

By 2020, India will become second overall in number with glaucoma, surpassing Europe. There will be six million more Chinese people with glaucoma. In 2020, the Europe region will still contain the greatest number of people with open-angle glaucoma, and the proportion of all those with angle-closure glaucoma that live in Asian regions will increase further to 87.6%.

It is important to improve diagnostic and therapeutic approaches to glaucoma that can be applied worldwide.

Glaucoma is currently recognized to be a multifactorial, progressive, neurodegenerative disorder. It is characterized by the acquired death of retina ganglion cells (RGC) and loss of their axons as well as optic nerve atrophy and loss of neurons in the lateral geniculate nucleus and the visual cortex. The central role of raised intraocular pressure (IOP) is being questioned as many patients continue to demonstrate a clinically downhill course despite control of initially raised IOP. The protection from retinal ganglion cell loss, one of the main characteristics of glaucoma, would be a straightforward treatment for this disorder.

OBJECTIVE: This review focuses on cellular events associated with neurodegeneration due to glaucoma, and discusses pharmacological agents believed to have a neuroprotective role in this disease. New intervention as pharmacological neuroprotection remains an important strategy to limit the morbidity of glaucoma representing significant health problem.

Key words: Glaucoma, optic neuropathy, apoptosis, pharmacological neuroprotection

demonstrate a clinically downhill course despite control of initially raised IOP. In addition, up to one-sixth of patients with glaucoma develop it despite normal IOP. Chronic heart failure is associated with lower ocular perfusion pressure, and glaucomatous optic nerve head changes. Visual field loss and RGC death continue to occur in patients with well controlled intraocular pressures and, thus, a consensus has recently emerged that additional treatment strategies are needed.

In humans, the optic nerve consists of approximately one million axons; whose cell bodies are primarily located in the ganglion cell layer. RGC death, therefore, represents the final common pathway of virtually all diseases of the optic nerve including glaucomatous optic neuropathy. There is histological and electrophysiological evidence to suggest that ganglion cells are the sole neurons affected in glaucoma. All animal cells are programmed for carrying out self-destruction when they are not needed, or when damaged. Apoptosis is a process rather than an event. It has been labeled a programmed cell death, or cell suicide. It is not unique to RGCs or glaucoma alone. Following an initial insult, the cells try to minimize or buffer the damage done through a variety of processes. Generation of "suicide triggers" could be one of the consequences of these processes and interactions and these molecules may start the process of apoptosis which is characterized by an orderly pattern of inter-nucleosomal DNA fragmentation, chromosome clumping, cell shrinkage and membrane blebbing. Abnormally high Ca2+ concentration leads to inappropriate activation of complex cascades of nucleases, proteases and lipases. They directly attack cell constituents and lead to the generation of highly
reactive free radicals and activation of the nitric oxide pathway. The resulting interaction between intermediate compounds and free radicals leads to DNA nitrosylation, fragmentation and activation of the apoptotic programme.

**TREATMENT Neuroprotective Therapy:**

The strategy of treating a disease by preventing neuronal death is termed neuroprotection. The term is used more narrowly to describe therapies to address final common pathways of damage in many neurological diseases ranging from Amyotrophic lateral sclerosis(ALS), Alzheimer’s disease and, in the context of the eye, glaucoma. The potential role of neuroprotective agents is to rescue of sick and dying cells and to maintain the integrity of healthy cells by providing resilience to a variety of hostile factors or agents.

The objective of neuroprotective therapy is to employ pharmacologic or other means to attenuate the hostility of the environment or to supply the cells with the tools to deal with these changes. According to this approach, any chronic degenerative disease may be viewed to have, at any given time, some neurons undergoing an active process of degeneration which contributes to the hostility of the environment surrounding it. The exponential loss of cells after secondary degeneration stems from the damage brought on other neurons that either escaped or were only marginally damaged by the primary injury. Neuroprotection attempts to provide protection to such neurons that continue to remain at risk. The idea of treating glaucoma with neuroprotection goes back to the 1990s, with Weinreb and Levin writing in Archives of Ophthalmology that, at the very least, neuroprotection should be an adjunctive therapy, along with lowering IOP. The concept of neuroprotective therapy for glaucoma is that damage to retinal ganglion cells may be prevented by intervening in neuronal death pathways.

Wheeler et al. proposed four criteria to assess the likely therapeutic utility of neuroprotective drugs with demonstrated utility in animal studies: The drug should have a specific receptor target in the retina/ optic nerve; activation of the target must trigger pathways that enhance a neuron’s resistance to stress or must suppress toxic insults, the drug must reach the retina/vitreous in pharmacologically effective concentrations and the neuroprotective activity must be demonstrated in clinical trials.

The major causes for cell death following activation of NMDA receptors are the influx of calcium and sodium into cells, the generation of free radicals linked to the formation of advanced glycation end-products (AGEs) and/or advanced lipoxidation endproducts (ALEs) as well as defects in the mitochondrial respiratory chain.

Calcium channel blockers have been shown to neutralize glutamate-NMDA-induced intracellular Ca2+ influx. Neuroprotective effect of calcium channel blockers against retinal ganglion cell damage under hypoxia was shown by Yamada et al. and also by Garcia-Campos et al. The general consensus is that intracellular concentrations of calcium ion are increased in apoptosis.

These findings suggest that calcium channel blockers may potentially inhibit ganglion cells and photoreceptor apoptosis in glaucoma. Understanding of the role of extracellular calcium transport across cell membranes in modulating various intracellular signaling processes, including the initiation of the apoptotic cascade, represents part of the rationale for interest in investigating calcium-channel blockers for neuroprotection in glaucoma.

The objective of this review is to evaluate the evidence and discuss the rationale behind the recent suggestions that calcium channel blockers may be useful in the treatment of glaucoma.

**PHARMACOLOGICAL NEUROPROTECTION**

Calcium channel blockers generally dilate isolated ocular vessels and increase ocular blood flow in experimental animals, normal humans, and patients with open-angle glaucoma and in patients who have vascular diseases in which considerable vascular tone is present. As well, contrast sensitivity in patients with normal tension glaucoma was found ameliorated by calcium channel inhibition.

In a retrospective study of normal-tension and open-angle glaucoma patients who happened to be taking calcium channel blockers, Netland et al. demonstrated a decrease in glaucoma progression relative to controls. Kittazawa et al. suggested visual improvement in a significant number of patients who took Nifedipine in a 6-month prospective study. Flunarizine, a potent calcium channel blocker has been demonstrated to enhance RGC survival after optic nerve transection in mice. These findings suggest that calcium channel blockers may potentially inhibit ganglion cells and photoreceptor apoptosis in glaucoma.

Otori et al. evaluated the effect of Diltiazem on inhibition of glutamate-induced apoptotic retinal ganglion cells death and concluded that application of Diltiazem do not appear to reduce apoptosis.

Nimodipine is an isopropyl calcium channel blocker which readily crosses the blood-brain barrier due to its high lipid solubility. Its primary action is to reduce the number of open calcium channels in cell membranes, thus restricting influx of calcium ions into
of vasospasmic hyperactivity. Luksch et al. 27 have reported a decreased retinal blood flow in NTG patients with clinical signs of hypoxia. Other authors 39 also stated that a single dose of 30 mg Nimodipine normalizes the significantly reduced retinal blood flow in healthy subjects and found that orally administered at a dosage of 30 mg three times a day Nimodipine significantly increases retinal perfusion in healthy subjects. The impact of Nimodipine on ocular circulation in normal tension glaucoma have been evaluated in many clinical studies.

Michelson et al., 37 have evaluated the impact of Nimodipine on retinal blood flow in double-blind, two-way, crossover study of healthy subjects and found that orally administered at a dosage of 30 mg three times a day Nimodipine significantly increases retinal perfusion in healthy subjects. The impact of Nimodipine on ocular circulation in normal tension glaucoma have been evaluated in many clinical studies.

Piltz et al., 38 have described a performance-corrected improvement in visual field deviation and contrast sensitivity in patients with normal tension glaucoma (NTG) and in control subjects in a prospective, placebo-controlled double-masked study after oral administration of Nimodipine (30 mg twice a day). Other authors 39 also stated that a single dose of 30 mg Nimodipine normalizes the significantly reduced retinal blood flow in NTG patients with clinical signs of vasospasmic hyperactivity. Luksch et al. 27 have examined the impact of 60 mg Nimodipine in NTG patients 2 hours after oral administration. Results disclosed that Nimodipine increased the blood flow of the optic nerve head by 18% and improved color-contrast sensitivity. Thus, Nimodipine is potentially useful calcium channel blocker for eye disorders treatment due to its high lipid solubility and ability to cross the blood-brain barrier.

Recent experimental evidences suggest that Nilvadipine appear to have beneficial effects on different ocular structures. Ogata et al. 40 have evaluated the effects of Nilvadipine on retinal blood flow and concluded that this agent may directly and selectively increase retinal tissue blood flow, while having only minimal effect on systemic circulation including arterial blood pressure. Another experimental study conducted by Uemura and Mizota 41 have also advocated the use of Nilvadipine for the treatment of glaucoma or other retinal diseases that have some relation to apoptosis, based on claims that Nilvadipine has high permeability to retina and neuroprotective effect to retinal cells. Otori et al. 42 in the experimental study of different calcium channel blockers protective effect against glutamate neurotoxicity in purified retinal ganglion cells has found that Nilvadipine significantly reduce glutamate-induced apoptosis.

In addition to direct effects of calcium channel blockers on intracellular concentrations of calcium ion in ganglion cells, other indirect effect is expected such as increased choroidal blood flow 28. Several clinical trials have shown the effectiveness of Nilvadipine in glaucoma.

Yamamoto et al. 42, Tomita et al. 43, Niwa et al. 44 have found that Nilvadipine reduces vascular resistance in distal retrobulbar arteries and significantly increases velocity in the central retinal artery in patients with normal tension glaucoma. Tomita et al. 43 also stated that reduced orbital vascular resistance after a 4-week treatment with 2 mg oral Nilvadipine consequently increases the optic disc blood flow.

Koseki et al. 28 conducted a randomized, placebo-controlled, double-masked, single-center 3-year study of Nilvadipine on visual field and ocular circulation in glaucoma with low-normal pressure. No topical ocular hypotensive drugs were prescribed.

The authors concluded that Nilvadipine (2 mg twice daily) slightly slowed the visual field progression and maintained the optic disc rim, and the posterior choroidal circulation increased over 3 years in patients with open-angle glaucoma with low normal intraocular pressure. The results of this study add to the growing body of evidence that Nilvadipine may be useful for neuroprotection in glaucoma.

Thus, Nilvadipine is potentially useful calcium channel blocker for eye disorders treatment due to its hydrophobic nature with high permeability to the central nervous system, including the retina and the highest antioxidant potency among calcium channel blockers.

The latest experimental study 45 evaluated a neuroprotective effect of another new calcium channel blocker – Lomerizine. The authors stated that Lomerizine alleviates secondary degeneration of retinal ganglion cells induced by an optic nerve crush injury in the rat, presumably by improving the impaired axoplasmic flow. Tamaki et al. 46 also investigated the effects of Lomerizine on the ocular tissue circulation in rabbits and on the circulation in the optic nerve head and choroid in healthy volunteers and have found that Lomerizine increases blood velocity, and probably blood flow, in the optic nerve head and retina in rabbits, and it also increases blood velocity in the optic nerve head in healthy humans, without significantly altering blood pressure or heart rate.

CONCLUSION

Currently, glaucoma is recognized as a multifactorial, progressive, neurodegenerative disorder.
and is characterized by the acquired death of retina ganglion cells, loss of their axons as well as optic nerve atrophy, loss of neurons in the lateral geniculate nucleus and the visual cortex. This concept emphasizes that several pressure-independent mechanisms are responsible for the development and progression of glaucomatous neuropathy and that high intra-ocular pressure and vascular insufficiency in the optic nerve head are merely risk factors for the development of glaucoma, and at the same time has led to a quest for identifying neuro-protective agents that can be used to safeguard the optic nerve.

Understanding of the role of extracellular calcium transport across cell membranes in modulating various intracellular signaling processes, including the initiation of the apoptotic cascade, represents part of the rationale for interest in investigating calcium-channel blockers for pharmacological neuroprotection in glaucoma. Taken into account the abovementioned eligibility criteria for neuroprotective drug, Nilvadipine meets them entirely and it is potentially useful calcium channel blocker for glaucoma treatment due to its hydrophobic nature with high permeability to the central nervous system, including the retina and the highest antioxidant potency among calcium channel blockers.

With exciting data now emerging from many research laboratories, it is obvious that pharmacological neuroprotection for glaucoma without doubt represents an exciting development in the search for a treatment modality for this debilitating disease.

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INTRODUCTION:

The advent and refinement of modern phacoemulsification techniques have revolutionized the ability to rehabilitate the patients with vision loss secondary to cataract. Cataract surgery is, far and away, the most commonly performed ophthalmic surgical procedure of any kind, and the use of phacoemulsification to remove cataract is increasing at a rapid pace worldwide.1 Although the postoperative visual and refractive outcomes of cataract extraction have been well studied, the concomitant changes in anterior chamber anatomy and physiology remain unclear. There is very little information on aqueous humor dynamics following phacoemulsification.

It has been widely reported that modern cataract extraction results in a long-term reduction in intraocular pressure (IOP). However, the magnitude and clinical significance of this change continues to be debated.2,3,4 This situation is especially pertinent in patients with glaucomatous comorbidities, in whom the decision to perform concomitant incisional glaucoma surgery along with cataract removal via phacoemulsification must be assessed taking into account the additional risks associated with such combined surgery. The ability of a surgeon to prospectively predict the postoperative IOP course in patients with coexistent cataract and glaucoma undergoing phacoemulsification would greatly advance ophthalmic care.

MATERIAL & METHODS:

Change in the IOP following cataract surgery:

Both the short and long-term effects of cataract extraction on IOP have been studied for many years. Although the technique and instrumentation for cataract extraction has advanced dramatically since the advent of modern phacoemulsification and minimally invasive clear cornea incisions, the long-term postoperative results with regard to visual improvement have been more or less unchanged over the past two decades. Similarly, there has been no evidence to suggest that the recent evolution of phacoemulsification with smaller, temporally located incisions and more efficient removal of lens material...
have had any significant impact on the postoperative IOP course.

Matsumura et al, approximately 15 years ago, prospectively analyzed 93 patients undergoing cataract surgery alone and demonstrated a 1.5-mmHg reduction in IOP at 3 years. In contrast, Suzuki et al, during the same era, showed no significant change in postoperative versus preoperative IOP at 10 years in circumstances in which preoperative IOP was less than 20 mmHg.

A few years later, Jahn demonstrated a consistent 2-mmHg reduction of IOP at greater than 5 years in 80% of patients undergoing uncomplicated phacoemulsification. Tong and Miller similarly found an approximately 2-mmHg reduction at 6–8 months postoperatively in patients undergoing cataract extraction with either a scleral tunnel or a clear corneal incision. A subset analysis of the study by Tong and Miller further demonstrated no significant impact of wound construction technique or anesthesia type (topical versus retrobulbar injection) indetermining postoperative IOP reduction. In contrast, Schwenne et al, in 2001, demonstrated an IOP reduction of 1.5 mmHg with a clear cornea incision, versus a 0.6-mm reduction with a scleral tunnel approach at 5 months postoperatively, in 100 patients undergoing uncomplicated cataract extraction.

The contradictory results of these early studies may reflect unique surgical techniques and methodologies for study design, data collection, and interpretation employed by each investigative group. Pohjalainen et al demonstrated a large, approximately 3.5 mmHg, IOP reduction postoperatively in 160 patients undergoing phacoemulsification alone, with a follow-up of between 1.0 and 2.7 years.

Shingleton et al demonstrated a more modest decline of 1.5 mmHg in ‘cataract surgery-only’ patients, and further showed larger decreases in patients diagnosed as or being suspicious for primary open-angle glaucoma (POAG). Recent reviews of the subject have reported a range of IOP reduction from 0.63 to 2.5 mmHg. Given this degree of variability in postoperative response, Issa, in 2005, demonstrated a novel index for predicting the degree of IOP reduction based on a ratio of the preoperative IOP and anterior chamber depth (pressure to depth ratio). This study demonstrated a consistently greater than 4-mmHg IOP reduction in patients with a pressure to depth ratio of more than 7 (IOP in mmHg/anterior chamber depth in mm). In these patients with supposedly normal anterior chamber anatomy, the anterior chamber depth was found to decrease, on an average, by 1.10 mm postoperatively. A recent study by Kimet al on the same subject demonstrated a 1.5-mmHg postoperative reduction in IOP at 1 month, with no change in diurnal IOP fluctuation relative to the preoperative period.

RESULTS:

Change in the IOP following Cataract Surgery in patients having Glaucoma:

A series of retrospective and prospective analyses over the last decade have consistently demonstrated reductions in IOP after cataract extraction in patients with glaucoma. These analyses have demonstrated large variability in the magnitude of IOP reduction apparently related, at least in part, to preoperative angle anatomy. Although it would be expected that one would achieve large magnitude reductions in patients with partially or completely closed angles, the mechanisms for the IOP reduction noted in patients with open angles remain poorly understood. Regardless, it is clear that careful preoperative examination including gonioscopy, and certain investigations i.e anterior chamber optical coherence tomography (AS-OCT) and ultrasound biomicroscopy (UBM) may improve the practitioner’s ability to predict the postoperative IOP course in selected cases during the preoperative period.

DISCUSSION:

Change in the IOP following Cataract Surgery in patients having Open-Angle Glaucoma:

Although Matsumura et al demonstrated a 1.5-mmHg reduction of IOP in ‘cataract surgery-only’ patients, they found 2.5- and 5.5-mmHg reductions in IOP for patients with controlled versus uncontrolled POAG, respectively, with a 3-year postoperative follow-up. In 2002, Friedman published a meta-analysis using the Cochrane methodology on approximately 40 studies of almost 5000 patients with various types of glaucoma and cataract undergoing cataract and/or incisional glaucoma surgery. This analysis revealed an estimated 2-4-mmHg IOP reduction with extracapsular cataract extraction (ECCE) or phacoemulsification, but determined that strong evidence for sustained long-term IOP control was found only for patients who underwent combined cataract extraction with trabeculectomy. Tezel et al, in the late 1990s, had previously reported that approximately 95% of eyes that underwent combined phacoemulsification and trabeculectomy maintained IOPs of less than 20 mmHg without medication as compared with 82% attaining the same result with cataract surgery alone over an average postoperative period of 15 months. Cimetta and Cimetta, in 2008, demonstrated a 3-mmHg greater IOP reduction postoperatively in patients with pseudo-exfoliation when compared with normal individuals (3.5 mmHg versus 0.48-mmHg reduction, respectively). Shingleton et al showed a modestly greater reduction in postoperative IOP for patients with cataract with...
coexisting POAG (1.8 mmHg) versus those with cataract without coexistent POAG (1.8 mmHg) at 5 years. In a 2008 retrospective review, this group further demonstrated that the postoperative IOP decline was statistically correlated with the preoperative IOP; patients with higher preoperative IOP obtained larger magnitude sustained reductions in IOP postoperatively relative to those with lower preoperative IOP. Poley17 substantiated these findings in a retrospective study of almost 600 patients undergoing simple cataract extraction, with upto 10 years of follow-up (range of 1–10 years, with over 50% having at least 4 years of follow-up). Patients were grouped on the basis of their preoperative IOP, and the largest magnitude reductions in postoperative IOP were found in patients in the highest pre-operative IOP group: a decrease of 6.5 mmHg in the 23–31-mmHg group, 4.8 mmHg in the 20–22-mmHg group, 2.5 mmHg in 18–19-mmHg group, 1.6 mmHg in the 15–17-mmHg group, and an increase of 0.2 mmHg in the 9–14-mmHg group. Other studies have demonstrated postoperative IOP reductions ranging from 1.85 mmHg to almost 4.5 mmHg in POAG patients.9,18–24

There is increasing evidence to suggest that the magnitude of IOP reduction following cataract surgery is positively related to the level of preoperative IOP. Although this effect appears logical and is supported by data, one must not discount the importance of the statistical phenomenon known as regression to the mean. IOP varies substantially around the mean in most patients, particularly in those with high-pressure levels, and numerous baseline IOP measurements should be taken (phasing) to understand the full effect of any IOP-lowering therapy. The number of baseline preoperative IOP measurements is not always apparent in several published articles on this topic.

A review of patients undergoing cataract extraction with either acute or chronic angle-closure glaucoma (ACG) further illustrates the impact of the preoperative diagnosis on IOP-lowering effect.

Change in the IOP following Cataract Surgery in patients having Angle-Closure Glaucoma

Wishart et al25 demonstrated in the late 1980s in a prospective analysis of 22 patients with primary CAG that ECCE resulted in IOPs of less than 21 mmHg in 65% of patients, whereas a retrospective analysis of 21 patients with POAG did not demonstrate the same findings. Hayashi et al26, in 2001, studied 74 patients with CAG and 68 with a diagnosis of POAG, and showed that although the IOP was significantly reduced in both groups, a larger percentage of patients with CAG (40.0%) did not require glaucoma medications postoperatively relative to those with POAG (19.1%).

Gunning and Greve26 demonstrated a remarkable 15-mmHg IOP decrease with combined trabeculectomy/cataract extraction and a 12-mmHg decrease with cataract extraction alone in patients with CAG at a mean follow-up of approximately 5 years. They further found an equal proportion of patients (68%) obtaining IOP control, with either combined cataract/trabeculectomy or cataract surgery alone, but the mean number of medications required for such control was lower in the combined surgery group. Similarly, Ge et al27, in a retrospective analysis of patients with either acute or chronic angle closure, demonstrated a greater than 11-mmHg IOP decrease after cataract extraction at approximately 8 months postoperatively.

In the acute treatment of angle closure glaucomas, studies comparing laser peripheral iridotomy (LPI) with primary cataract extraction have also demonstrated IOP lowering, with the later group obtaining more significant reductions. Both Lam28 and Hata29 in 2008 demonstrated 2.4- and 2.8-mmHg additional decreases in IOP for cataract surgery patients as compared with those undergoing LPI alone, respectively. Pacimuth and Intajak30 demonstrated an almost 6-mmHg IOP reduction in 58 eyes with acute angle closure glaucoma or CAG when treated with primary phacoemulsification and lens implantation. Mierzejewski31, also in 2008, demonstrated 4.4- and 6.0-mmHg IOP reductions following phacoemulsification in POAG and CAG patients, respectively.

It can be ascertained from all of these studies that the presence of closed-angle anatomy predisposes patients undergoing cataract extractions to larger decreases in IOP when compared with normal and POAG counterparts. Euswas and Warrasak32, in 2005, further quantified these differences by dividing angle-closure patients into two groups, distinguished by the degree of closure; group-I included those with less than 180 degrees of such closure, whereas group-II showed less than 270 degrees of peripheral anterior synechiae. They demonstrated a 3-mmHg greater IOP reduction postoperatively in patients from group-II versus those in group-I (5 versus 2 mmHg, respectively).

CONCLUSION

Although there is definitive evidence showing that IOP is reduced, on average, following phacoemulsification, in patients with or without glaucomatous disease, the magnitude and duration of this effect needs further studies. Patient-specific factors, including angle anatomy, likely predict the expected postoperative reduction; yet, elucidation of such factors has been suboptimal to date. Further, the mechanisms that lead to IOP reduction following cataract surgery in patients with open angles remain poorly understood. It has been theorized that phacoemulsification surgery increases the postoperative aqueous outflow facility, and cultured
trabecular meshwork cells have been found to release interleukins and tumor necrosis factors, which may lead to increased synthesis of matrix metalloproteinases in the trabecular meshwork. Further research will likely allow a better understanding of these postoperative changes.

In contrast, it has been shown that the magnitude of IOP reduction following cataract surgery in patients with angle-closure glaucoma is related to the degree of such closure. There is substantial evidence in support of the use of cataract surgery as an important treatment modality for both acute angle-closure glaucoma and CACG in phakic individuals. Cataract and glaucoma are the two leading causes of morbidity associated with diseases of sense organs worldwide. Given the frequent coexistence of these two conditions, the management of patients requiring simultaneous cataract removal and IOP lowering warrants further studies, with regard to both basic mechanisms and clinical outcomes.

REFERENCES:
Postoperative Astigmatism following Phacoemulsification: Versus Extracapsular Cataract Extraction

Faisal Nawaz Khan, Naseer Ahmed, DOMS, Amir Naseem, Muhammad Idrees, Muddasar Hussain

Objective: To compare the magnitude of postoperative induced astigmatism and visual acuity following phacoemulsification versus extracapsular cataract extraction.

Materials and Methods: This study was conducted at LRBT Free Secondary Eye Hospital, Mansehra from June 2012 to September 2012. This was a comparative study in which total of 60 patients were selected from amongst patients who presented in the OPD with cataract. These patients were divided into 2 groups designated Group-A and Group-B respectively. In Group-A, patients were included whom Phacoemulsification with posterior chamber rigid intraocular lens was implanted. In Group-B, Standard Extracapsular Cataract Extraction followed by posterior chamber rigid intraocular lens implantation was carried out. These cases were followed up as two separate groups. Preoperatively their visual acuities and K-readings were taken from which any astigmatism was calculated by simple subtraction method. Postoperatively these variables were recorded on each follow-up visit, which were scheduled at 1st day postoperatively followed by one week, three weeks, six to eight weeks and twelve weeks. Finally the visual outcome in terms of visual acuity and surgically induced astigmatism were compared between the two groups on each follow-up visit.

Results: Post-operative induced astigmatism was less in group A patients as compared to group B patients in all follow up visits. Post operative visual acuity was significantly better in group A as compared to group B patients all through the follow up.

Conclusion:

• Surgically induced astigmatism is significantly more following standard ECCE as compared to the small incision phacoemulcification followed by posterior chamber IOL implantation.
• Phacoemulsification is clinically superior to ECCE.

Keywords: Phacoemulcification, Astigmatism, Extra capsular cataract extraction, Visual acuity, Intra ocular lens.

INTRODUCTION

According to the World Health Organization (WHO), cataract is the leading cause of blindness and visual impairment throughout the world. With the general aging of the population the overall prevalence of visual loss as a result of lenticular opacities increases each year. In 2002, the WHO estimated that cataracts caused reversible blindness in more than 17 million (47.8%) of the 37 million blind individuals worldwide, and this number is increasing to reach 40 million by 2020. The WHO proposes that between 2000 and 2020, the number of cataract surgeries performed worldwide will need to triple in order to keep pace with the needs of the population. (1)

Cataract surgery is possibly the oldest surgical procedure and is now the most frequently performed surgical procedure in the western world. (2) It is performed with the aim of improving vision and surgery has considerably been changed in recent years. Advancement in techniques and improvements in instruments have enabled surgeons to achieve a better visual outcome. In the past the cataract surgeons concentrated on removal of the opaque lens so as to allow the passage of light into the globe. With advancement efforts were made not only to remove the cataractous lens but also to ensure that light is brought to an optimum focus on the retina, so that the patient could have good uncorrected visual acuity.

The evolution of cataract surgery in the recent past saw intracapsular cataract extraction falling in disregard and its place being taken over by extracapsular cataract extraction. The advent of intraocular lens further improved the post operative visual acuity as it dispensed the need for aphakic glasses. More recently advances of small incision surgery using phacoemulsification have revolutionized cataract surgery. It is now performed with high expectations of success by both surgeons and patients alike.

The major part of the focusing power of the eye is contributed by the cornea and not the lens. Therefore it is obvious that a slight change in the corneal curvature can affect the precision with which light is focused on to the retina. The technique of surgery, the incisions made for the surgery and the stitches applied, all have

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the potential to alter the corneal shape and refraction of the eye.

It has been known for quite sometime that cataract surgery is associated with changes in corneal curvature which can bring about alteration in the refracting surface of the cornea i.e. the anterior surface. These changes can be associated with induction of astigmatism and thus limit visual rehabilitation post operatively. Originally, all extracapsular techniques involved nuclear expression, but in 1967 Charles Kelman MD, developed phacoemulsification, which differed from conventional ECCE with nuclear expression by the size of the incision and the method of nucleus removal. (3)

The main difference between extracapsular cataract extraction and phacoemulsification lies in the removal of the lens nucleus. In the former the nucleus is removed in one piece through a 9-10mm incision whereas in the latter it is remove piece-meal through an incision of 3mm, which can be increased if a non-foldable lens is used. Since the incision length is the most important factor for the surgically induced astigmatism, (4) therefore the small incision used in phacoemulsification would induce minimal post operative astigmatism, less post operative inflammation and early visual recovery. The better visual results achieved using phacoemulsification has transformed cataract surgery from an operation to restore vision to a refractive procedure in which the surgeon manipulates the surgical parameters to provide the patient with the best possible vision both with and without spectacles. Few operations give such an improvement in health (5).

Since cataract is one of the main causes of preventable blindness, therefore to counteract this increasing backlog, efforts have been made to increase the output of cataract surgery services in the country. However the outcome of this surgery is not always as desired and so much more attention needs to be given to this aspect of the procedures followed.

A study was carried out at LRBT Free Eye Hospital Mansehra from June 2012 to September 2012, to evaluate the surgically induced astigmatism following phacoemulsification using a 5.5mm incision and conventional extracapsular cataract extraction followed by posterior chamber non-foldable intraocular lens implantation in both groups.

Visual acuity and astigmatism were recorded on both groups preoperatively followed by the two different procedures. Postoperatively the same were again recorded and compared on each follow up visit. It was hypothesized that the patients undergoing phacoemulsification will have less induced astigmatism and a better postoperative visual acuity at every checkup of this study.

MATERIALS AND METHODS:
This study was conducted at LRBT Free secondary eye hospital Mansehra from June 2012 to September 2012. Ethical committee approval was taken from Research Ethics Committee LRBT Karachi. This was a comparative study in which total of 60(100%) patients were selected from amongst patients, presented in the OPD with cataract. These patients were divided into 2 groups designated Group-A and Group-B respectively. In Group-A patients were included whom phacoemulsification with posterior chamber rigid intraocular Lens was implanted. In Group-B, Standard Extracapsular Cataract Extraction followed by posterior chamber rigid intraocular lens implantation was carried out. These cases were followed up as two separate groups. Preoperatively their visual acuities and K-readings were taken from which any astigmatism was calculated by simple subtraction method. Postoperatively these variables were recorded on each follow-up visit, which were scheduled at 1st day postoperatively day followed by one week, three weeks, six to eight weeks and twelve weeks. Finally the visual outcome in terms of visual acuity and surgically induced astigmatism were compared between the two groups on each follow-up visit.

**TABLE – 1** Total number of patients in the study

<table>
<thead>
<tr>
<th>GROUPS</th>
<th>NO. OF PATIENTS</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group – A</td>
<td>30</td>
<td>50%</td>
</tr>
<tr>
<td>Group – B</td>
<td>30</td>
<td>50%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>60</td>
<td>100%</td>
</tr>
</tbody>
</table>

**TABLE – 2** Distribution of patients according to sex (n = 60)

<table>
<thead>
<tr>
<th>GENDER</th>
<th>GROUP – A</th>
<th>GROUP – B</th>
<th>GROUP – A</th>
<th>GROUP – B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male Patients</td>
<td>17</td>
<td>56.66%</td>
<td>14</td>
<td>46.66%</td>
</tr>
<tr>
<td>Female Patients</td>
<td>13</td>
<td>43.33%</td>
<td>16</td>
<td>53.33%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>30</td>
<td>100%</td>
<td>30</td>
<td>100%</td>
</tr>
</tbody>
</table>

**TABLE – 3** Age wise distribution

<table>
<thead>
<tr>
<th>AGE</th>
<th>GROUP – A</th>
<th>GROUP – B</th>
<th>GROUP – A</th>
<th>GROUP – B</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 – 55 years</td>
<td>10</td>
<td>33.33%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>56 – 60 years</td>
<td>8</td>
<td>26.66%</td>
<td>2</td>
<td>6.66%</td>
</tr>
<tr>
<td>61 – 65 years</td>
<td>6</td>
<td>20%</td>
<td>11</td>
<td>36.66%</td>
</tr>
<tr>
<td>66 – 70 years</td>
<td>6</td>
<td>20%</td>
<td>17</td>
<td>56.66%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>30</td>
<td>100%</td>
<td>30</td>
<td>100%</td>
</tr>
</tbody>
</table>
DISCUSSION

This study was conducted at LRBT Free Eye Secondary Hospital Manshera to compare clinical outcome in terms of surgically induced astigmatism and postoperative visual acuity at predetermined follow up visits. In this study, a total of 60 patients were divided into two groups comprising 30 cases each. Group-A underwent phacoemulsification with a clear corneal incision, which was later extended to 5.5mm to accommodate a non-foldable posterior chamber IOL. Group-B patients underwent ECCE with a 9-10mm incision followed by posterior chamber IOL implantation.

In Group-A, the mean magnitude of induced astigmatism on the first postoperative day was around 2.02D and on the last follow up visit there was almost no difference with the preoperative values. In Group-B, there was marked change on the first postoperative day with the mean of 3.48D and towards the end of the study there still remained a significant degree of astigmatism, although the trend was that of neutralization towards its preoperative keratometry values.

Mission and Birmingham\(^6\) has done a study on keratometry and postoperative astigmatism. They stated that postoperative refractive astigmatism and Keratometric corneal astigmatism were determined in patients following cataract surgery by comparing the results of the two methods. The value of keratometry is that it is a simple and quick procedure for identification of surgically induced astigmatism. It is proposed that this method should be used before final refraction in an attempt to increase clinical efficiency and to reduce further follow-up appointments resulting from surgically induced astigmatism.

The results of our study are comparable to the one carried out by Watson and Sunderraj\(^7\) who carried out a comparative study of small incision phacoemulcification with standard ECCE. They compared postoperative astigmatism and visual recovery. These results are comparable to our study. They carried out a prospective study on astigmatism and visual acuity (corrected and uncorrected) following phaco and ECCE.

47 eyes were implanted a 5x6mm optic IOL, through with 5mm scleral incision after phaco and 50 eyes were implanted with 7mm diameter IOL after ECCE. Uncorrected visual acuity of 6/9 or better was achieved in 25% of eyes on the first day following phaco, 36% at one week and 57% at 12 weeks. These results (and also the best corrected visual acuity) were significantly better than those following ECCE. Less astigmatism was induced by phaco than ECCE.

<table>
<thead>
<tr>
<th>TABLE – 4 Distribution of patients according to treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Left eye</td>
</tr>
<tr>
<td>Right eye</td>
</tr>
<tr>
<td>TOTAL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TABLE – 5 Comparison of amount of pre-operative astigmatism in both groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTIGMATISM</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>0D to 0.5D</td>
</tr>
<tr>
<td>0.51D to 1.0D</td>
</tr>
<tr>
<td>1.1D to 2.0D</td>
</tr>
<tr>
<td>TOTAL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TABLE – 6 Comparison of amount of post-operative astigmatism in both groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visit</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>1st Day</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>1st week</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>3rd week</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>6-8 weeks</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>12th week</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
measured at all postoperative time intervals.\(^{(7)}\)

Small incision cataract surgery allows for early rehabilitation of patients and improved control of postoperative astigmatism. The astigmatism was very low and the required astigmatism correction was in the order of 0.75D.\(^{(8)}\) These were conclusions of a study carried out by Hashmani, Haider and Ali. The conclusions of our study are to similar effect.

In a study conducted at Sheikh Zayed Hospital, it was found that almost 70% of the patients undergoing phaco with IOL implantation, a best corrected visual acuity of 6/6 to 6/12 was achieved.\(^{(9)}\)

In our study in Group-A, 86% of patients had induced astigmatism of less than 1.0D at 12 weeks time. This could be favorably compared with a study conducted by Afzal and Khawaja in which they reviewed 120 cases of phacoemulsification. They found that 64% patients had less than 1.0D of astigmatism and 37% had less than 2.0D of induced astigmatism.\(^{(10)}\)

In a study carried out at Liaquat Medical College it was reported that better postoperative visual acuity with minimum induced astigmatism was achieved following phaco as compared to the conventional ECCE technique. The results of our study are comparable with this study.\(^{(11)}\)

<table>
<thead>
<tr>
<th>VISUAL ACUITY</th>
<th>GROUP – A</th>
<th>GROUP – B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No of Pts</td>
<td>%age</td>
</tr>
<tr>
<td>UPTO 6/24</td>
<td>3</td>
<td>10%</td>
</tr>
<tr>
<td>6/36 – 6/60</td>
<td>25</td>
<td>83.33%</td>
</tr>
<tr>
<td>CF / PL</td>
<td>2</td>
<td>6.67%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>30</td>
<td>100%</td>
</tr>
</tbody>
</table>

In an audit carried out at Addenbrook’s Hospital-UK, the final visual acuity of 6/12 or better was achieved in 81% of cases undergoing cataract surgery through phaco. This is comparable with our results of group-A patients.\(^{(12)}\)

The difference between phaco and ECCE lies in the incision size, therefore not only phaco but any small incision surgery would yield better results in comparison to a large incision surgery. A study on these lines was done and was found that a procedure referred to as manual small incision cataract surgery would give better uncorrected visual acuity. This study reports outcome at 1 week and 6 weeks after and it shows persistent better visual outcome for patients undergoing manual small incision cataract surgery.\(^{(13)}\)

In a study published by Malik, Qazi and Gilbert it was revealed that the visual outcome in eyes operated on using phaco and those undergoing ECCE were similar. Since this outcome is different from our study, it is possible that bias could have played a role in this. The most likely bias could be that phaco is a difficult procedure to master and therefore in the hands of a not so experienced surgeon its results would be similar to ECCE. In our study the source of bias in favor of phaco is the age factor. Patients were comparatively more younger than those undergoing ECCE. Therefore predictably the visual outcome would be better. Another bias is that in the group undergoing ECCE the cataract is more mature as mature cataract patients were excluded from the phaco group.\(^{(14)}\)

CONCLUSION:

- Surgically induced astigmatism is significantly more following standard ECCE as compared to the small incision phacoemulsification followed by posterior chamber IOL implantation.
- Visual acuity is better at every postoperative stage and visual rehabilitation rapid following cases
undergoing phacoemulsification in comparison to ECCE.

- Phacoemulsification is clinically superior to ECCE

REFERENCES:


A Simple Method to Diagnose Glaucoma

Syed S. Hasnain M.D 1, Sikandra Hasnain B.A. 2

INTRODUCTION:

A simple method to diagnose glaucoma is being presented which is based on the hypothesis that the optic disc is sinking, not cupping, in chronic glaucoma. 1,2,3 In order to diagnose glaucoma based on the sinking optic disc, we must replace currently used school of thought: cupping and optic disc neuropathy, with the following new paradigms.

Paradigm 1.
The optic disc is sinking in the scleral canal.
Paradigm 2.
Due to sinking of the disc, the nerve fibers are being stretched and ultimately severed against the scleral edge, an optic disc axotomy.

The term “cupping” which implies gradual enlargement of the physiological cup in glaucoma is misnomer for two reasons. First, the physiological cup is not truly enlarging but disintegrating, in glaucoma. Second, we are already using the term cupping describing various sizes of physiological cups, therefore, the use of term pathological cupping causes unnecessary confusion in glaucoma diagnosis.

What is a physiological cup of the optic disc?
The physiological cup of the optic disc is of various sizes that are produced by varying degrees of atrophy of Bergmeister papilla 4, a tuft of hyaloid vessel in fetal life. If we review the histology of the normal optic disc, the remnant of the papilla base is identified as central connective tissue meniscus lying superficially on the surface of the nerve fibers layer. The meniscus forms the base of the physiological cup, therefore the larger the meniscus, the bigger the size of the cup. Consequently, a larger cup would be covering more area of the nerve fibers and thus smaller exposed area or rim of the disc.

It has been mentioned that the axons are concentrated in the rim area only, and the cup itself is devoid of axons. However, the histology of a normal optic disc reveals that underneath the meniscus, the entire lamina is packed with nerve fibers and there is hardly any empty space. 5 In fact, the physiological cup is not an integral part of the optic disc and has no clinical significance. Many optic discs have minimal cup or none at all. Since the physiological cups are composed of fibrous tissue, it is unlikely they would become enlarged due to raised IOP because of lack of elasticity.

This presentation will demonstrate that the changes occurring in the glaucomatous disc are mainly due to severing of the prelaminar nerve fibers and blood vessels as a result of sinking disc- a mechanical problem. These pathological events are supported by morphological and histological findings of the glaucomatous discs.

What happens to the optic disc after severance of nerve fibers?

Severing of the nerve fibers results in excavation or empty spaces in the disc, whereas severing of the blood vessels results in hemorrhages at the disc margin, peripapillary atrophy and characteristic pallor devoid of inflammation. Severance of the nerve fibers results in thinning of the RNFL as revealed by optical coherence tomography (OCT). Severing of the nerve fibers and blood vessels is a unique feature of glaucoma as no other optic disc disease exhibits such a phenomenon.

In addition to the border tissue, the optic disc is anchored in the scleral canal by 360 degrees of the nerve fibers, similarly to the roots anchoring a tree. As the optic disc starts sinking due to atrophy and weakness of the border tissue, the prelaminar nerve fibers become stretched and ultimately severed at the scleral edge. Due to depletion of the nerve fibers, the anchorage of the optic disc is weakened and disc sinks further resulting in severing of additional nerve fibers. The cascade of sinking and severing of the nerve fibers become self-propagated and will continue until all the nerve fibers are severed. This phenomenon may explain as to why
glaucoma cannot be halted despite lowering of the IOP maximally.

**Evaluation of the optic disc for glaucoma.**

While evaluating the optic disc for glaucoma we have to keep two things in mind: the glaucomatous disc is **sinking** and as a result the nerve fibers and vasculature are being **severed**. If we observe the morphological features of the glaucomatous disc in the context of severing of the nerve fibers, then we would not only determine the glaucoma in its earliest stage, but every stage of the glaucomatous disc with our naked eye; all we may need is an ophthalmoscope or preferably a digital fundus camera.

**How do we determine if the optic disc is sinking?**

By observing the course of blood vessels as they cross at the junction of the retina and the optic disc: if the course of blood vessels from the retina on to the surface of the disc is straight and the optic disc appears flush with the retina then, of course, the disc is not sinking. We should observe the course of the blood vessels at the disc margin, not to confuse with the normal bending of the blood vessels occurring at the margin of the physiological cup. As the optic disc starts sinking, the blood vessels will also start sloping in pursuit of the sinking disc. The aforementioned simple observation with our naked eye will clearly tell us if the disc is sinking or not.

This article will present the pictures of glaucomatous discs from their earliest to the late stage of the six glaucoma subjects and we would evaluate them in the context of severing of the nerve fibers and its vasculature as a result of the sinking disc.

**Stages of the glaucomatous discs:**

Since the changes occurring in the glaucomatous discs are gradual and continuous, it is difficult to divide them into definitive stages. However, arbitrarily glaucomatous changes may be divided into three stages.

**Early Stage:**

Due to the inherent temporal tilt of the disc, the temporal part will reveal glaucomatous changes first. Temporal area will appear pale due to severance of the smaller blood vessels, whereas the temporal scleral edge/border area will appear prominent and visible due to severance and thus thinning of RNFL. Fig 1-6. Splinter hemorrhages may also appear due to severing of the blood vessels at the disc margin. In the early stage there is usually no change in the contour of the physiological cup. There may be generalized peripheral field constriction but usually no arcuate field defects at this stage.

**Intermediate stage:**

Due to severing of the nerve fibers the excavation or empty spaces are produced in the optic disc. In cases of optic discs with minimal physiological cups the sinking of the disc appears more obvious. Fig 4 Notching in the superior and inferior pole of the physiological cup will start appearing due to severance and depletion of the arcuate fibers. Since the...

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**Figure 1** same subject: A. Early glaucoma left eye: Temporal pallor and increased visibility of the temporal scleral edge/rim area. B. Intermediate glaucoma right eye: Inferotemporal area appears pale, sunken and sloping of blood vessels. Increased visibility of the scleral edge due to thinning of RNFL. Arcuate field defects present.
A simple method to diagnose glaucoma

Figure 2 same subject: A. Early glaucoma right eye: Temporal pallor, increased visibility of the temporal scleral edge due to thinning of RNFL. Physiological cup still intact. B. Intermediate glaucoma left eye: Temporal area more sunken, increased visibility of rim and more sloping of the blood vessels. Physiological cup being obliterated due to excavation created by severance of the RNFL.

Figure 3 same subject: A. Early glaucoma left eye: Temporal pallor, increased visibility of the scleral edge. B. Intermediate glaucoma right eye: Inferotemporal area pale, sunken and sloping of temporal vessels. Scleral edge area more visible due to thinning of RNFL. Arcuate field defects present.
Figure 4 same subject: A. Early glaucoma right eye: Temporal pallor, increased visibility of the temporal scleral edge and sloping of the blood vessels. B. Late glaucoma left eye: Temporal area more pale, sunken and marked visibility of the scleral opening due to thinning of RNFL. Nasal shifting of blood vessels due to severance of the temporal nerve fibers.

Figure 5 same subject: A. Early glaucoma right eye: Temporal pallor and increased visibility of the temporal scleral edge. Physiological cup still intact. B. Late glaucoma left eye: Marked pallor, excavation and kinking of the vessels at the entire rim. Entire scleral opening is visible due to extreme thinning of the RNFL.
physiological cup is now obliterated, it may be called an intermediate stage.

At this stage the visual field defects would start appearing in the paracentral area due to severance and depletion of arcuate fibers. The sloping of the blood vessels will turn into kinking due to progressive depletion of nerve fibers. The central retinal vessels will begin to shift nasally due to loss of anchorage resulting from the severance of temporal nerve fibers.

**Analogy:** if the roots of a tree are severed from one side, the tree will shift to the opposite side.

**Late to End-stage:**

In the late stages of glaucoma, the more of the disc area becomes pale and excavated. Due to extreme thinning of the RNFL the entire scleral opening will become visible. Fig 4-6 The area around the disc margin would appear bald due to severance and disappearance of the smaller blood vessels whereas the larger blood vessels would remain hanging on the scleral edge, Fig 4-6.

In summary, the histology of the end-stage glaucomatous disc resembles a totally empty bean-pot which can only be explained if severance, not atrophy of the nerve fibers is occurring. The glaucomatous discs illustrated in this presentation are of six subjects in which one eye has early glaucoma and the contralateral eye in an intermediate or late stage. All these glaucomatous discs reveal the same pattern from the very early to the late glaucoma stage, resulting from the severing of the nerve fibers and vasculature. I believe my colleagues would find my presentation appealing and may agree: if there is no sinking of the disc then there is no glaucoma, irrespective of cupping

**References:**

2. Hasnain SS. Scleral edge, not optic disc or retina is the primary site of injury in chronic glaucoma. Medical Hypothesis 2006; 67(6) ;1320-1325
3. Hasnain SS, Hasnain AB. Is glaucoma a Neurodegenerative Disease? Could it be a mechanical problem and not a neurodegenerative disease? Ophthalmology Update July-Sept, 2012 10(3); 299-301
While attending medical school in Latin America, I was in utter perturbation to listen to my professor telling me that only peer-reviewed articles from the United States would be accepted for our oral presentation. I was disheartened because I was unable to utilize any extraordinary and intriguing articles written by my host country’s outstanding physicians and scientists. Left and perched in utter confusion, I wondered the loss of great ideas and studies from the fertile and fruitful minds, which are not necessarily peer-reviewed and published in glossy journals. Moreover, I was saddened to realize that majority of the peer-reviewed journals are available at exorbitant costs for subscription. This leaves much of the scientists in the world not being able to be involved in the exchange of ideas and sharing of experiences of even senior colleagues.

In fact, non peer-reviewed forms of research, ideas, and studies are deprived of ever being considered for discussion. Journal clubs, presentations, citations, are all steadily requiring research to be from journals with much rigid safeguarding essentially making others obsolete and unread. Thus, we are creating an undesirable tradition for the younger generations where they are being subjected to ignore anything that is not accessible via PubMed or any indexing agency.

There are myriad of articles written on important and current scientific topics that major journals choose to ignore because there is no ‘scientific consensus’ on such material. However, the question arises of how would there ever be a consensus if the journals have no room for such unorthodox articles? We are convinced that these ideas would be ignored forever unless we intrinsically review and motivate ourselves to read beyond the typical peer-reviewed manuscripts. Let’s not forget, that in 1875 German researchers had hypothesized that bacteria may be the culprit for gastric ulcers, but these studies never received any attention because of not having shown any acceptable scientific basis. It is not until 1984 did they rediscovered the causative relation between H. Pylori and the gastric ulcers. Had the scientific community cared to take a serious notice of this scientific innovation, they would have saved the humanity from immense sufferings. There are hundreds and thousands of scientific paradigms, theorems, hypothesis and inventions which were evaded under careless and arguably selfish motives, resulting in great scientific backlogs.

Apparently, the policy behind the much-emphasized importance of peer-reviewed journals is to remove scientific material that is not agreed upon by particular peers, editors, or associations. Such publications are inherently flawed as they leaves no room for novel and unorthodox ideas to ever become introduced to the flourishing minds. Such ideas, though fewer in number as compared to approved articles of normal scientific research. These ideas are left to journals of small circulation and online presentations.

Our advice to the students, residents, and physicians is to pay attention to such open-accessed journals, which provide a platform for progressive scientific ideas of equal importance. In fact, it is an amalgamation of all these ventures whether peer-reviewed or not, that we evolve a scientific consensus whether these ideas fit within scientific domain. And if these ideas do not fit the current scientific consensus, do not completely discard them; let us utilize our inquisitive scientific inquiry to evaluate its possible validity. It is only with this non-conventional analysis that we can maximize and direct the growth of scientific study and its application.

Finally, in the words of Ralph Waldo Emerson: “Men love to wonder, and that is the seed of science.”
Ophthalmology Notebook

**Letters to the Editor**

**CONGRATULATIONS - RECOGNITION BY HEC**

Dear Prof. Durrani,

I am pleased to learn the Ophthalmology Update being approved and recognized by the Higher Education Commission. Congratulations, this will definitely solve many problems of the ophthalmic faculty members from medical universities of the country. Well done. Best Regards

Prof. Khalid Talpur, Hyderabad.

Dear Prof. Durrani,

AOA, Congratulations Sir, great achievement for yourself and all the contributing ophthalmologists. Regards

Prof. Brig Majeed Malik, CMH Lahore Medical College

Respected: Prof. M.Yasin Khan Durrani

Editor-in-Chief, Ophthalmology Update

Sir, Let me share sincere compliments on achieving such a great honor and excellence. It is a marvelous achievement and great landmark in your career that you have joined the fraternity of success by getting the journal recognized by HEC. This is Almighty’s befitting reward for your concerted efforts. It is only because of your most angelic nature. Sir, you have a character of sterling excellence. You never leave your work of today for the next day. The Almighty Allah gives this opportunity to those who are favorite to Him. We offer you whole hearted congratulations on this remarkable feat.

Most sincerely

Professor Dr. Sameen Afzal Junejo, Dept. of Ophthalmology Liaquat Uni. of Medical and Health Science, Jamshoro.

President Elect: OSP Hyderabad/Sindh.

Dear Prof. Yaseen Durrani

Congratulations for recognition of Ophthalmology Update by HEC. Regards

Dr. Ghulam Rabbani Dahri, President OSP Hyderabad.

Dear Prof. Durrani

Congratulations! Prof. Durrani for this fertile achievement.

Prof. Syed Imitaz Ali Shah, Dean, SBB Medical University, Head of Ophthalmology, Chandka Medical College, Larkana

Very Respected Prof. Durrani,

Sir, I am really thankful for your thoughtfulness and kindness for accepting my article for publication. I must avail this opportunity to express my heart felt and humble appreciations for your dedication, commitment, and endless efforts to make this journal a success, in particular, recognition by HEC and to serve the cause of ophthalmology in general. With a lot of regards.

Dr. M. Abdul Moqeet, Assoc. Professor,

PIO, Al-Shifa Trust Eye Hospital, Rawalpindi

Dear Prof. Durrani,

I gratefully acknowledge the receipt of International ‘OPHTHALMOLOGY Update’ Vol: 10 No:4 October-December’2012, it is excellent in both, contents and presentation. The copy has been placed in Shifa Library to attract a wider readership. With regards,

Maj. Gen. (Retd) Professor Muhammad Aslam

Principal, Shifa College of Medicine & VC, Taamir-i-Millat University, Islamabad

Dear Prof. Yasin Durrani

I hope you must be enjoying EID. May Allah bless you and your family with all the happiness of the life. Amin! You are very blessed and spiritual person and very close to Allah. Your dedication in publication of Ophthalmology Update is a proud achievement.

When I first knew about you and your Journal I was amazed to find your dedication in publishing a high class international Journal at your own. I said to myself “The future of Pakistan can’t be bleak if Pakistan is blessed with dedicated persons like you” It is not at all easy to publish at your own and that is why Journals are published by the associations. It is really very commendable that you are publishing for the past 10 years.

I was only 26 when I left Pakistan and have lived most part of my life outside Pakistan. I have done nothing for Pakistan whereas you have dedicated your entire life serving Pakistan. Yourself and other ophthalmologists serving in Pakistan had the same opportunity as I had in settling in the developed countries abroad, but you chose to serve Pakistan. I salute you and all the other ophthalmologists serving in Pakistan despite difficult circumstances.

When I had intuition of my ‘sinking disc hypothesis’ I was so excited that if I am correct then my discovery will not only be a pride for Pakistan but for the entire Muslim world. This is the only consolation I have for not settling in Pakistan because in Pakistan I believe I would have got so busy by the enormous workload that most probably I would not had time to think outside the box. Accept heartiest felicitation for acceptance of the journal by HEC. Many thanks and best regards

Syed S. Hasnain M.D. General Ophthalmology

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Health is Wealth

Apple fruit (Malusdomestica)
nutritional facts

Zainab Inam, Nowshera

Apples belong to Rosaceae family, originally cultivated in the mineral-rich mountains of Kazakhstan, and now in many parts of the world.

Delicious and crunchy apple fruit is one of the most popular fruits, favorite of health conscious, fitness lovers who believe in the concept “health is wealth.” This wonderful fruit is packed with rich phyto-nutrients that in the true senses indispensable for optimal health. The antioxidants in apple have much health promoting and disease prevention properties, thus truly justifying the adage, “an apple a day keeps the doctor away.”

Apples are low in calories, 100 g of fresh fruit provide only 50 calories. They, however, contain no saturated fats or cholesterol. Nonetheless, the fruit is rich in dietary fiber, which helps prevent absorption of dietary-LDL or bad cholesterol in the gut. The fiber also saves the colon mucous membrane from exposure to toxic substances by binding to cancer-causing chemicals inside the colon.

Apples are rich in antioxidant phyto-nutrients flavonoids and polyphenolics. The total measured antioxidant strength (ORAC value) of 100 g apple fruit is 5900 TE. Some of the important flavonoids in apples are quercetin, epicatechin, and procyanidine B2. Additionally, they are also good in tartaric acid that gives flavor to them. Altogether, these compounds help the body protect from deleterious effects of free radicals.

Apple fruit contains good quantities of vitamin-C and beta-carotene. Vitamin C is a powerful natural antioxidant. Consumption of foods rich in vitamin C helps the body develop resistance against infectious agents and scavenge harmful pro-inflammatory free radicals from the body. Further, apple fruit is a good source of B-complex vitamins such as riboflavin, thiamin, and pyridoxine (vitamin B-6). Together these vitamins help as co-factors for enzymes in metabolism as well as in various synthetic functions inside the body.

Apple also contains a small amount of minerals like potassium, phosphorus, and calcium. Potassium is an important component of cell and body fluids helps controlling heart rate and blood pressure; thus, counters the bad influences of sodium. It helps in maintaining overall good health, prevents early ageing process specially maintaining good vision by preventing cataract and age-related macular degeneration. Fresh apples can be kept at room temperature for few days and stored inside the refrigerator for two to three weeks. Wash them in clean running cold water before use to remove any surface dust and pesticide/fungicide residues. Eat apple fruit along with their peel in order to get maximum health-benefits. Sliced apple turns brown (enzymatic brownish discoloration) on exposure to air due to conversion in iron form from ferrous oxide to ferric oxide. If you have to serve them sliced, rinse slices in water added with few drops of fresh lemon. Apple fruit is also used in the preparation of fruit jam, pie, and fruit salad.

Safety profile

According to the environmental-working group reports, apple fruit is one of the heavily pesticide-contaminated product. The most common pesticides found on apple are organo-phosphorous and organo-chloride pesticides like Permethrin and DDT. Therefore, it is recommended to wash the fruit thoroughly before use.

### Apple fruit (Malusdomestica) 
Fresh, Nutritive value per 100 g  
(Source: USDA National Nutrient data base)

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Value</th>
<th>% of Daily Value</th>
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<tbody>
<tr>
<td>Energy</td>
<td>50 Kcal</td>
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<tr>
<td>Carbohydrates</td>
<td>13.81 g</td>
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<td>Protein</td>
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<td>Total Fat</td>
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<td>Cholesterol</td>
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<td>Folic acid</td>
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<td>Vitamin A</td>
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<td>Vitamin C</td>
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<td>Vitamin E</td>
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<td>Vitamin K</td>
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<td>Electrolytes</td>
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<tr>
<td>Sodium</td>
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<tr>
<td>Potassium</td>
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<td>Minerals</td>
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<tr>
<td>Calcium</td>
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<td>Iron</td>
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<tr>
<td>Magnesium</td>
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<tr>
<td>Phosphorus</td>
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<td>Zinc</td>
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<td>Phyto-nutrients</td>
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<td>Carotene-α</td>
<td>27 µg</td>
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<tr>
<td>Crypto-xanthin-β</td>
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<tr>
<td>Lutein-zeaxanthin</td>
<td>29 µg</td>
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Next Meeting of the
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“SAUDI OPHTHALMOLOGY”
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