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Nano-ophthalmology

A nascent yet a burgeoning field at Nano Frontiers

The tiny world of Nano-science may one day stand shoulder to shoulder with Nanotechnology in the gigantic field of industry and medicine, it is a fast emerging technology of immense socio-economic value………Nano experts

Though in early stages, nanotechnology is underway to Ophthalmology. It involves materials and devices of incredibly small size — less than 100 nm, known as Nanoceria. (to compare, a strand of DNA is 2 nm wide). Nanoparticles are colloidal carrier systems that can improve the efficacy of drug delivery by overcoming diffusion barriers, permitting reduced dosing (through more efficient tissue targeting) as well as allowing sustained delivery. In fact, it is an interesting and minimally invasive field of Ophthalmology. Although molecular technology is still in infancy, yet it is no longer a speculative field which may revolutionize the future of Medicine as it unfolds the mysteries of this exciting field. However, the accomplishments are tremendous and the future prospects are wide open.

Much progress has been achieved in the field of nanotechnology and its applications to ophthalmology. Drug discovery, delivery, gene therapy, implantable devices and regenerative medicine are some of the key areas of active research in Nano-ophthalmology which may soon be available in the clinician’s armamentarium to maintain and restore the eye sight.

Currently, Biopharmaceuticals and diagnostic tools are some of the areas getting importance in this field. Moreover, Nanotechnology is also playing an important role in the treatment of conditions associated with the oxidative damage particularly AMD, diabetic retinopathy and degenerative disorders like Retinitis Pigmentosa. The technology allows new and innovative monitoring approaches e.g. one non-invasive approach to IOP monitoring involves the use of wireless, silicone contact lens with a sensor to measure changes in the corneal curvature related to IOP changes with the help of a microprocessor and an antenna integrated into the contact lens.

One early innovation is a biosensor DNA tied to a magnetic nanoparticle. The antioxidant biosensor could provide a means for clinician to identify patients likely to need therapy e.g. Retinopathy of Prematurity who will need photocoagulation or other treatment at a time before clinical manifestations of a severe disease are evident. Currently, the technology is undergoing a significant development in controlling the therapeutic gene therapy as well. One such application is the treatment of various retinopathies caused by oxidative stress. This will allow the regeneration of diseased cells, not killing the healthy cells in order to get rid of every bad cell as happens while treating with radiation or chemotherapy.

A further advance in Regenerative Ophthalmic Medicine would be to replace damaged or dead retinal neurones in patients with chronic retinal detachment,
RP, AMD and allied disorders. Regenerative Medicine is no doubt a nascent yet a burgeoning field of Ophthalmology, certainly not insurmountable. According to Prof. Marco A. Zarbin, PhD., Institute of Ophthalmology and Visual Science, University of Medicine & Dentistry of New Jersey., “Biodegradable (poly) lactic-co-glycolic Acid (PLGA) microspheres loaded with intra-vitreal glial-derived neuro-trophic factor (approved by FDA for human use) provides sustained ganglion cell protection in Glaucoma. The prospects are very exciting for the physicians solving their multi-faceted problems by offering a control over; how molecules interact with one another in giving them ability to respond to their environment with sapient behaviour.

In fact, nano-materials have large surface area to interact and to bring a chemical reaction. They have altered functionality like 100 times stronger than steel and can melt gold at room temperature. It has a molecular self-assembly basically putting molecules where you want them to be, what you want them to do and when you want them to do. Nano-technology is the art of designing and building machines in which the specifications are determined down to molecule. The technology is very cost-effective allowing mass production at a lowest cost even for a therapy of longer duration by delivering minute quantities to precise target having few or no side effects.

Pakistan has already entered into the field of Nanotechnology and it is very encouraging to learn that the Preston University in Islamabad has started a BS – 4 years degree course at undergraduate degree level at the Institute of Nano-science & Technology (PINSET) under the guidance of Prof. Emeritus Dr. N. M. Butt, a renowned atomic scientist as its chairman. Any student interested in the field of Nano-science can join such institution. Recently, Quaid-e-Azam University, Islamabad held an international conference on Nano-science & Technology. Eminent teachers from Pakistani and foreign Universities participated in the conference, discussing the impact this technology on vast number of fields and the future prospects of applications in Pakistan. Another tripartite seminar was jointly organized by the Preston Institute of Nano-Science & Technology (PINSAT) and the International Development Research Centre (IDRC) Canada, in which scientists from Sri Lanka, India and Pakistan strongly emphasized that Pakistan should seriously consider development of Nano technology manpower in the country.

In this context, Ophthalmology Update can also provide guidance to young aspirants who wish to specialize in the progressive field of Medicine especially in Nano-Ophthalmology, which will provide them invaluable opportunities to diagnose and treat their patients on better lines. Ophthalmic medicine of the future could find new tools for the problems considered intractable. The application of this rapidly growing field will ultimately ensuring the healthful longevity of life.

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OBITUARY

Ah! Prof. Syed Ali Haider

A great friend, a great teacher and a best vitreo retinal surgeon……

Prof. Nadeem Hafeez Butt

The whole medical community in general and the ophthalmic community in particular is deeply shocked at the sad and sudden demise of Prof. Ali and his son. They were brutally martyred recently in Lahore.

Dr. Syed Ali Haider was the only son of Prof. Zafar Haider and Professor Tahira Bokhari. He graduated from K.E.M.C in 1987 and proceeded to the UK to complete his FRCS in Ophthalmology. He returned to serve his country with dedication and devotion. Prof. Ali had a brilliant record of academic eminence in pursuit of knowledge in the field of Ophthalmic Sciences. It speaks volumes of his creditable contributions to take the Pakistan Journal of Ophthalmology to enviable heights as the Editor in Chief. He worked very hard to achieve professional excellence and earned a prestigious place in the Ophthalmic community as Professor of Ophthalmology and a venerated academician at Lahore General Hospital.

Dr. M Afzal Bodla from Multan knows him from the very childhood as a student at Nishter Medical College, Multan, as he grew with all capabilities of his father Prof Syed Zafar Haider. Besides these qualities of head and heart he was an extraordinary human being and a soft spoken gentleman. We pray that God may give courage to the family to face this irreparable loss.

According to Dr. Syed S. Hasnain from California USA, he is survived by his wife, a teenaged son and a six month old daughter. He will be sorely missed by his family, friends, relatives, and thousands of patients. May Allah grant him peace in paradise.

The brotherly Afghan ophthalmologists have expressed their profound grief over the untimely death of Prof. Ali Haider at a very young age. He was extremely kind and caring to the Afghan patients being referred to him for vitreo-retinal consultation.

The management and the editorial board Ophthalmology Update offer sincerest condolences to his family, his students, colleagues and whole ophthalmic community.

Prof. M. Yasin Khan Durrani,
Editor in Chief, Ophthalmology Update,
Islamabad
Computerized Documentation & Analysis of the Pseudo-isochromatic Plate Colour Vision Test Results
(A software for colour vision testing)

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ABSTRACT
Background: Computerized recording and analysis of conventional colour vision test results is desirable, and software has been developed for colour matching tests. However, the need exists for such software for pseudo-isochromatic plate tests (PIPT).
Methods: A software written in Microsoft Visual Basic for the purpose of recording and interpretation of conventional PIPT results is described in detail.
Conclusion: The prototype software has a potential to be utilized in routine clinical practice and epidemiological studies, and the large amount of data thus obtained may be efficiently recorded, interpreted and archived in short time and with very few resources.
Key Words: Colour Vision, Computers in Medicine, Optic nerve

INTRODUCTION:
Accurate determination and recording of the colour vision (CV) is important in many clinical settings. Apart from its well established value in the determination of optic nerve damage and congenital CV deficits, gradual deterioration in color vision can help to detect several diseases in very early stages e.g. diabetic retinopathy,1 Parkinson’s disease,2 multiple sclerosis,3 etc.
The pseudo-isochromatic plates test (PIPT) is the most popular and convenient technique for screening and diagnosis of abnormal CV,4 the Ishihara5 and Hardy-Rand-Rittler6 being the most familiar of these tests. In spite of being simple to carry out, these tests can consume significant time in the out patient clinics because of the frequency with which they have to be carried out. Apart from the large number of tests performed for screening, repeated testing and plate-to-plate comparison of the results with prior ones is necessary to detect change in optic nerve function. Furthermore, a baseline CV test needs to be performed in all patients prior to the initiation of the drugs known to have adverse effects on the optic nerve to rule out existing color defects and hence avoid later confusions.7 The volume of CV testing is thus quite large. Maintenance of the record of response to every individual plate in every test makes the task considerably complex. Similarly, to utilize the feature of these tests to determine the type of CV defects, correct interpretation of the response to each plate is essential. Full utilization of PIPT is thus time consuming and may not be possible in a busy out-patient clinic.

As the availability of personal computers is now common in the clinics, any software which allow quick recording of the response of the patient to each plate in every testing session, can interpret the faulty response as specific to a known type of color vision deficiency, and retrieve prior results for comparison, can be useful in this regard. Such software could be used in many specialties of medical sciences besides ophthalmology, particularly neurology, general medicine, pediatrics and in mass screening by the medical or non-medical staff.

Description of an application developed for recording, interpretation and retrieval of the patient’s response to each plate in the conventional Ishihara test is presented in this article.

METHODS
Description of Software: The software is written in Microsoft Visual Basic.6 (Microsoft Corporation, Redmond, Washington), by one of the authors (SAR)
Software Algorithm: The software is based on
Ishihara [38 plate Edition – 1973, Kanehara Shuppan Co., Ltd. Tokyo, Japan] and the first 25 plates are taken as the standard test. Interpretation of response as normal, specific abnormal, or non-specific abnormal is done by the application after matching each response according to the information in the booklet provided with the test book.

The software is distributed as a zipped file, named: “Rizvi’s CVR&AS.zip” contents of which are first extracted in a known folder. The ‘Setup.exe’ file in that folder is then clicked to complete the installation process. Minimum screen resolution required is 1024 X 768 pixels. In windows 7, writing “rizvi” in the program search box will retrieve the application, and in windows XP it will be listed in the start program menu. The software can be obtained free of charge via email to the corresponding author or downloaded from the following link: http://rapidshare.com/files/633714883/Rizvi’s CVR%26AS.zip

The start page offers the option of either starting a new test, or retrieval of results of a test done previously.

For the new test, the patient’s particulars are entered and the button captioned ‘Start Test’ is clicked. The second screen then appears, where there are 25 buttons on the left of the screen representing the first 25 plates in the Ishihara PIPT in sequence. The standard Ishihara book is given to the patient and the conventional test is started. When the patient gives the response to the fist plate, the button no. 1 is clicked and the patient’s response entered in the entry box, which appears beside the button. This is repeated for the rest of the 25 plates. At each button press, an image of the corresponding plate appears on the computer screen, which is only for the examiner, to make sure that the correct sequence of plates is entered. At the completion of the test the ‘FINISH’ button at the bottom of the screen is clicked, which leads to the final results screen. The results contain the patient’s response, the correct answer, and the interpretation of each plate. The overall score is also mentioned as number of plates correctly identified. The examiner gives the results a file name in the appropriate box, to be saved for the future reference. If desired, comments are entered in the ‘Comments’ box. A print out can be taken at this stage to be included in the patient’s medical record (MR) file. Any file name can be allotted to a test result but it is useful to include the patients MR number and the date on which the test was performed. For example, the file name for a test performed by a patient with a MR number ‘123abc’ on the 12th of June 2012 can be ‘123abc-120612’. All the files are saved in the installation directory by default.

For retrieval of prior results, the file name for that test is entered in the retrieval box and the retrieval button clicked.

**INTERPRETATION**

If a response to a slide is incorrect and specific to any known type of CV deficit, the fact is mentioned by the software on the result screen besides that plate number, otherwise this is remarked as ‘Incorrect: Non Specific’. The correct response is remarked ‘Correct’. Figure 1 shows the test results of a Red-Green deficient person

**DISCUSSION**

Computer assisted analysis of the results of a conventional test is not a new idea. The most familiar example is the software developed for the Farnsworth-Munsell 100 Hue test. Recording and computation of results in the PIPTs is not as complex as in the FM 100 Hue test, yet software for these tests is needed because they are performed far more frequently in clinical practice. This prototype software was based on the Ishihara PIPT, but it can be written for any PIPT using the same principle.

This software is quite comprehensive, but there is much potential for upgrading. e.g. a database software can be incorporated, making the test very useful for epidemiological studies, and can be carried out even by non medical personnel, e.g., school teachers. Similarly, the results can be linked to the patient’s electronic MR, which is rapidly becoming the standard of medical record keeping.

**CONCLUSION**

At present, the images of the PIPT appearing on the computer screen are solely for identification purpose for the examiner, the test being carried out conventionally as usual. However, personal computer monitor is being evaluated as a potential medium for the patient to discriminate the colours. If significant evidence of the accuracy of this method becomes available, the need for the conventional printed plates may be obviated completely after standardization and calibration of the color display in the computer monitor.

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Visual Outcome after Endolaser versus Cryopexy in Vitrectomy for Retinal Detachment

Mir Ali Shah FCPS¹, Nuzhat Rahil FCPS², Rahil Malik FCPS³
Mohammad Jawad MBBS⁴, Asif Iqbal MBBS⁵

ABSTRACT
Purpose: To analyze the postoperative visual outcome after Endolaser and Cryopexy in patients undergoing parsplanan vitrectomy for rhegmatogenous retinal detachment.

Material and Method: This retrospective study was conducted to know visual outcome after retinal cryo and endolaser during pars plana vitrectomy on all patients between age 16 years and 60 years admitted with the diagnosis of rhegmatogenous retinal detachment with PVR grade C in Khyber Institute of Ophthalmic Medical Sciences, Lady Reading Hospital Peshawar in 2008 and 2009. Cryopexy to breaks and/ or retinal degenerations was applied when endolaser was not available in 2008 while Endolaser was used in 2009. The visual outcome was assessed in terms of preoperative and first postoperative visual acuity and any improvement, loss or no change was recorded.

Results: The total number of patients was 85. Out of these 61 were male and 24 were female. The preoperative visual acuity was light perception (PL) with good projection in 40% of patients, 42.35% of patients presented with hand motion (HM) while 11.76% patients had the vision of counting finger (CF) close to eye. The rest of 4.76% patients had vision of 1/60 and better. Endolaser was performed to the breaks in 43 patients while cryo-retinopexy was performed in 42 patients. The visual acuity on 10th postoperative day improved in 51.16% of patients and deteriorated in 34.88% of patients with Endolaser. In those patients who received cryo the vision improved in 40.47% and deteriorated in 35.71%.

Conclusion: Endolaser retinopexy around the tear is relatively easy to perform for retinal surgeons. Endolaser and cryopexy around the tear after pars plana vitrectomy and internal tamponade has no significant difference regarding affect on the visual outcome.

Key words: endolaser, retinal cryo, rhegmatogenous retinal detachment, parsplana vitrectomy

INTRODUCTION

The surgical management of rhegmatogenous retinal detachment has evolved dramatically during the past two decades. Investigators have introduced and refined alternative techniques to scleral buckling surgery including primary pars plana vitrectomy (PPV). Rapid parallel developments in instrumentation, including wide-angle viewing systems, per florocarbon liquids, novel vitrectomy machines, intraocular tamponade, and Endolaser photo coagulators have lead to increased sophistication in primary PPV surgical techniques for the treatment of rhegmatogenous complicated retinal detachments.

Retinal surgeons frequently uses retinopexy as a means of creating an extra strong adhesions between retina and retinal pigment epithelium(RPE) that will strengthen attachments. Phctocoagulation produces a bond that approaches normal adhesive strength within 24 hrs. Cryopexy however weakens adhesions for the first few days after which the adhesive forces rises to the level as with other form of retinopexy. Thus all forms of retinopexy appear to be equally effective in the long term, however if rapid bond is required, laser photocoagulation is preferable. One potential disadvantage of cryo therapy is dispersion of RPE cells in addition cryo does not permanently damage the choroid, it does produce choriodal congestion. It also causes postoperative cystoid macular oedema which is mostly responsible for low vision. Photocoagulation compared with cryopexy causes less breakdown of the blood ocular–barrier and the thermal effect is confined predominantly to the retina and pigment epithelium with little or no effect on the choroid and sclera. Finally photocoagulation produces an adhesive effect between the retina and pigment epithelium within hours. Cryo is more painful under local anesthesia and produces lid oedema and conjunctival chemosis.

The purpose of this study was to assess the first postoperative visual acuity in those patients who underwent pars plana vitrectomy with cryopexy or endolaser as mode of inducing adhesive effect.
MATERIAL AND METHODS.

It was a prospective study of visual outcome after cryo and Endolaser during pars plana vitrectomy on all consecutive patient between age 16 years and 60 years admitted with the diagnosis of rhegmatogenous retinal detachment with PVR grade C in Khyber Institute of Ophthalmic Medical Sciences, Lady Reading Hospital, Peshawar in year 2008 and 2009. All these cases were operated by single surgeon (MAS). The inclusion criteria comprised of all those patients who had rhegmatogenous retinal detachment and had PVR grade C and in whom PPV was done with endolaser or cryopexy was performed for adhesive purposes.

Exclusion criteria included those patients below 16 yrs of age, repeat surgery and PVR Grade A and B.

Files of all the patients were reviewed to get informations on detailed preoperative assessment including visual acuity, detail dilated fundoscopy using indirect and 78 or 90 diopter lens and assessment of the retinal detachment including extent, type of break and assessment of PVR. After three port pars plana vitrectomy, fluid air exchange and silicone oil (1000 Centi stokes) and application of endolaser or cryo to the break, the visual acuity on 10th post operative day was assessed and the visual outcome was determined in terms of improvement, deterioration and no change was recorded. Data analysis was done by SPSS (10.0). Related frequencies and percentages were calculated.

RESULTS:

Out of these 85 patients 61 (71.76%) were male and 24 (28.23%) were female (Figure). The preoperative visual acuity was perception of light in 34 (40.00%), hand motion in 36 (42.35%) while 10 (11.76%) patients had the vision of counting finger close to eye and 4 (4.76%) patients had vision of 1/60 and better (Table 1). Cryopexy was the adhesive procedure in 42 (49.41%) and endolaser was used to the break in 43 (50.58%) patients (Table 2). Out of 42 patients who received cryo for adhesion of retina during PPV the vision improved in 17 (40.47%) patients and deteriorated in 15 (35.71%) No improvement or loss was recorded in 10 (23.80%) eyes. The visual acuity after endolaser improved in 22 (51.16%) patients and deteriorated in 15 (34.88%) patients and no change in visual status was observed in 6 (13.95%) (Table 3).

DISCUSSION

Primary PPV offers potential advantages in the treatment of rhegmatogenous RD, accurate internal search for breaks, good visual and anatomical result, and higher reattachment rate with endolaser or cryopexy to the break.

The total number of treated patients who were operated for RD with PPV was 85. In a study done by Yeh et al eighty-one eyes in 71 patients who had undergone PPV were included in the study. The results were better in the group where cryo was applied to peripheral retina and sclerotomy sites, although all patients were diabetic in this study.11 In another study done by Kwok et al in 25 myopic patients with macular hole and RD, a single row of argon laser around macular hole was compared with no laser and no significant difference was noted.12

In this study 70 patients presented with the preoperative vision of HM or only perceptoin of light. The late presentation, trauma and comorbidity were the reasons behind most of such cases. In a study done by Garthy et al on 114 eyes 56% of patients had the preoperative VA of 1/60 and better.13 Our study showed that in those patients who received endolaser to the break, the visual acuity improved in 22 (51.16%) patients and deteriorated in 15 (34.88%) patients and no change
in visual status was observed in 6 (13.95%). In a study done by Garthy et al best corrected visual acuity was improved in 92 eyes (81%), unchanged in 14(12%), and worse in eight (7%) after PPV.

In our study those patients who received cryo to the break during PPV, the vision improved in 17 (40.47%) patients and deteriorated in 15 (35.71%). No improvement or loss was recorded in 10 (23.80%) eyes. This is almost similar to the study by Brazitikos in which the mean and final best-corrected visual acuity (log MAR) was 0.33 in the PPV group with cryopexy 14. Our study result does not reveal significant difference in the two groups but the literature is quite deficient in such comparisons of these two adhesive procedures.

CONCLUSION
Endolaser retinopexy around the tear is relatively easy to perform for retina surgeons. Endolaser and cryopexy around the tear after pars plana vitrectomy and internal tamponade has no significant difference regarding affect on the visual outcome.

REFERENCES:
INTRODUCTION

The viral conjunctivitis is caused by many viruses but adenovirus is the commonly causative organism. The incubation period of the disease is one week and is highly contagious for several weeks after the onset of symptoms. Generally adenoviral conjunctivitis is benign and self-limiting disease. Epidemic keratoconjunctivitis (EKC) is commonly associated with sub-types 8, 19 and sometimes 37. Adults between the ages 20 to 30 are commonly affected. The EKC spreads in epidemics by person to person contact particularly in crowded communities with poor hygiene e.g., schools, swimming pools and military camps. The conjunctival infection causes extreme watering, redness and foreign body sensation called catarrhal conjunctivitis. On examination there is lid edema, conjunctival chemosis and mechanical ptosis. Conjunctival follicles and fine tarso-conjunctival papillae of the lower lid are mainly involved. Corneal involvement causes intense photophobia due to punctuate epithelial lesions. Later on sub-epithelial infiltrates appear at the level of the Bowman membrane as a hypersensitivity reaction to the viral antigens. These sub-epithelial infiltrates may coalesce to form deep lesions called nummular keratitis. Preauricular lymphadenopathy is a common sequel.

Diagnosis is mainly based on the clinical features alone. However, other causes of follicular conjunctivitis e.g., herpes simplex virus and chlamydial infection should be excluded. Adenoviral enzyme immunoassay is a specific and confirmative test.

The prevention of transmission is the most important therapeutic measure. Although the disease is benign and self-limiting, the use of topical antihistamine and decongestant drops markedly reduce the severity and duration of the symptoms.

Keywords: adenoviral, epidemic, antihistamine, decongestant

ABSTRACT

Objective: This study was conducted to evaluate the effectiveness of using topical antihistamine (pheniramine maleate) and decongestant (naphazoline) eye drops in reducing the severity and complications of adenoviral conjunctivitis during an epidemic.

Study design: Randomized controlled trial (RCT)

Place and duration of study: Three months study from June 2012 to August 2012 was conducted at ophthalmology department, Combined Military Hospital, Abbottabad.

Patients and Method: A total 1570 cases of adenoviral conjunctivitis were documented during the months of June, July and August 2012. By simple randomization 200 patients were selected and divided into two groups on the basis of treatment. Group 1 (treatment group) 40% patients were given topical antihistamine and decongestant drops whereas Group 2 (control group) 60% patients were managed conservatively by washing eyes with cold water and applying ice packs on the eyes.

Results: In most cases (90%) both eyes were affected. Acute illness lasted from 4.50 days in group 1 and 7.65 days in group 2. Commonly observed symptoms included redness, watering, itching, burning and pain in the eyes and photophobia. The duration of illness was less and the severity was mild in group 1 as compared to group 2 patients. This was found to be statistically significant using Chi-square test (p<0.05). None of the case reported any complication after recovering from the infection.

Conclusion: Adenoviral conjunctivitis is a highly contagious disease and often spreads in epidemics particularly in crowded communities with poor hygiene. Prevention of the transmission is the most important therapeutic measure. Although the disease is benign and self-limiting, the use of topical antihistamine and decongestant drops markedly reduce the severity and duration of the symptoms.

Keywords: adenoviral, epidemic, antihistamine, decongestant
anti-inflammatory agents reduce severity of the symptoms. Topical steroids should be avoided in the conjunctival infection as they are known to prolong the course of the disease.\textsuperscript{15}

\textbf{PATIENTS AND METHODS}

This study was conducted in the ophthalmology department of combined military hospital, Abbottabad from 01 June 2012 to 31 August 2012; the time when an epidemic spread in Abbottabad area.

A record of all officers, troops, their families and civilians who suffered from the viral conjunctivitis was maintained at staff surgeon, medical reception center\textit{(MRC)}, family outpatient department\textit{(family OPD)} of combined military hospital, Abbottabad, Pakistan Military Academy Hospital, Kakul and other military establishments throughout Abbottabad during the months of June, July and August 2012.

A questionnaire was designed and response was obtained from 200 randomly selected army personnel and their families and children who suffered from adenoviral conjunctivitis during the epidemic. The questionnaire was pre-tested on a sample to ensure clarity of interpretation and ease of completion to improve validity of the responses.

Patients (n=200) were divided into two groups on the basis of treatment. Group 1 patients (n=80) were treated with topical antihistamine/decongestant (pheniramine maleate 0.3\% and naphazoline hydrochloride 0.025\%) whereas Group 2 patients (n=120) were treated conservatively by washing eyes with cold water and applying ice packs on the eyes.

\textbf{RESULTS}

Highest incidence of the disease was seen in the month of July 2012 (Table 1). Out of a total of 200 selected patients, both eyes were affected in 180 (90\%) patients whereas single eye was affected only in 20 (10\%) patients. (Table 2)

Mean duration of illness in group 1 was 4.50 days whereas it was 7.65 days in group 2. Most commonly observed symptoms noted amongst the respondents included redness of eyes, watering, pain (including itching and burning) and photophobia. All the symptoms were graded from grade 0 to 3 depending upon the severity.

Grade 0 Absence of any complaint
Grade 1 Mild (+1)
Grade 2 Moderate (+2)
Grade 3 Severe (+3)

The duration of symptoms in group 1 and 2 are depicted in table 3. Duration of the illness as well as severity of the symptoms was less and statistically significant in group 1 patients as compared to group 2 (p < 0.05). Chi-square test was used for statistical data analysis. None of the patients reported any complication after complete recovery from adenoviral conjunctivitis.

\textbf{DISCUSSION}

Adenoviral conjunctivitis is the commonest type of viral conjunctivitis that frequently appears in epidemics. Although it is benign and self-limited, it is highly contagious and spreads by exposure to the affected person particularly through health care workers.\textsuperscript{5,6} Conjunctival infection causes extreme watering, redness and foreign body sensation called catarrhal conjunctivitis. Epidemic keratoconjunctivitis is commonly responsible for epidemics and is usually associated with sub-types 8 and 19.\textsuperscript{8} Purpose of this study was to minimize the patient’s discomfort by using topical antihistamine and decongestant eye drops. Patients were divided into two groups on the bases of treatment. Patients in group 1 (40\%) were treated with topical antihistamine and decongestant (pheniramine maleate 0.3\% and naphazoline hydrochloride 0.025\%) while group 2 patients (60\%) were treated conservatively by washing eyes with cold water and applying ice packs on the eyes. Highest incidence of
the disease was seen in the month of July 2012 when humidity was at its peak. In 90% cases both eyes were affected. Most commonly observed symptoms were redness of eyes, watering, itching, burning, photophobia and pain in the eyes. Duration of the illness as well as severity of the symptoms was mild and statistically significant in group 1 patients as compared to group 2 (p < 0.05). Results were comparable with similar studies of Buerhler et al and Rosenbach et al.5,16

**CONCLUSION**

Adenoviral conjunctivitis is a highly contagious disease and often spreads in epidemics particularly in crowded communities with poor hygiene. It is extremely important to teach the masses about the nature of disease, treatment and prevention of its spread. Prevention of transmission is the most important therapeutic measure by avoiding close contact of the affected person and not sharing towel used by him. In the ophthalmic clinics of the hospitals hands must be washed with soap and water before and after examining the patient. Thorough sterilization of instruments touching the patient’s eye must be carried out and frequent changing of multi use eye drops is extremely important.

Although the disease is benign and self limiting, cold compresses and topical antihistamine and decongestant eye drops markedly reduce the discomfort, severity and duration of the adenoviral conjunctivitis during an epidemic.

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The Frequency of Amblyopia & Results of Squint Surgery in Patients admitted in Khyber Teaching Hospital, Peshawar*

Ayat Shah1, Sadia Sethi FCPS2, Omer Ilyas,MBBS3, Zaman Shah, FCPS4

ABSTRACT:
Objectives: The objectives of the study were to find out the frequency of Amblyopia and post operative ocular alignment of squint patients.

Material and Methods: This prospective study was conducted in Eye A ward of Khyber Teaching Hospital Peshawar from 1st Jan 2012 till 30th Oct 2012. Patients were examined over 9 months. The details of each patient were recorded by orthoptist pre operatively and then at approximately 1 week interval post operatively. At each visit a full orthoptic assessment was done including visual acuity, prism cover test, and assessment of binocular single vision using tests appropriate for the age. Other parameters were also recorded by orthoptist but have not been analyzed in this study. Eyes with alignment of 10 prism diopters were considered as straight and all the rest would be considered as misaligned.

Results: Total of 115 patients were analyzed pre operatively. Out of these 115, 92 patients (80%) were esotropic of which 63 (54.78%) were of unilateral esotropia and 29 (25.22%) were of alternating esotropia. Of these pre operative patients 54(46.91%) were males and 61(53.04%) were females. There were total of 35 patients up to 10 years of age(30.43%), from 10-16 years were 33(28.70%),from 16-25 years were 34(29.56%) and above 25 years were 13(11.30%) in number. Patients in whom complete post operative assessment was done were 95 in number and rest were lost in follow up. Out of these 95 patients that have been assessed post operatively 85(89.47%) patients were having straight eyes at 1 week post operatively i.e., deviation within 10 prism diopters of straight, residual squint was found in 8 patients (8.42%) and consecutive squint was found in 2(2.11%) patients. Out of 115 patients, 38(33.04%) patients were having amblyopia. Amblyopia was checked by visual acuity chart (Longmar visual acuity chart, Snellen chart and correction of refractive error). Stereopsis was absent both pre and post operatively in 44(46.32%) checked by Titmus Fly test, Lang test, Frisby test. Suppression and post operative diplopia was checked by Worth four light test and Bagolini test.

Conclusion: The study shows that most of patients with unilateral squint were having amblyopia, having frequency 33.04%. The results of squint surgery were satisfactory. The ratio of female was greater than male.

Key Words: Amblyopia, Residual Squint, Consecutive Squint

INTRODUCTION
Strabismus is a common problem in ophthalmology, the prevalence ranges from 3-5%1. The first documented treatment for strabismus occurred in 1839 and was performed by Johann Friedereich Dieffenbach, a general surgeon2. A substantial information exists demonstrating that accurate alignment will lead to a better long term outcome with regard to both binocular function and cosmesis3. The indications for surgery are 1) elimination of double vision, 2) improvement of three dimensional vision, 3) expansion of visual field, 4) elimination of abnormal head posture, 5) improvement of psychological function, 6) improvement of vocation status4. The accuracy of strabismus surgery is usually assessed in terms of alignment within 10 prism diopters of straight3. Most of these operations are corrections of horizontal eye position by relocating the insertion of one eye muscle on the eye a few millimeters backward (recession) and resecting the tendon of its antagonist (resection). The treatment goals for strabismus surgery in adult patients is to alleviate double vision (diplopia) and to improve cosmetic appearance. In children the treatment goals are to preserve binocular vision in worsening or short-onset strabismus and to improve cosmesis5. Strabismus usually results in normal vision in the preferred sighting (or fellow) eye (patient’s prefers to use), but may cause abnormal vision in the deviating or strabismic eye due to the difference between the images projecting to the brain from the two eyes7. Strabismic amblyopia is treated by clarifying the visual
image with glasses, and/or encouraging use of the amblyopic eye with an eye patch over the dominant eye or pharmacologic penalization of the better eye. Penalization usually consists of applying atropine drops to temporarily dilate the pupil, which leads to blurring of vision in the good eye. This helps to prevent the bullying and teasing associated with wearing a patch, although application of the eye drops is more challenging. The ocular alignment itself may be treated with surgical or non-surgical methods, depending on the type and severity of the strabismus.

MATERIALS AND METHODS

This prospective study was conducted in Eye A-ward of Khyber Teaching Hospital Peshawar from 1st February 2012 till 30 the October 2012. Patients were recruited over 9 months. One surgeon was asked to indicate the intended post operative surgical alignment. The decision was based on the clinical judgment of surgeon involved. Since only the accuracy of ocular alignment was being analyzed, no attempt was made to standardize the surgical objectives or techniques among the participating surgeons.

The details of each patient were recorded by orthoptist pre-operatively and then at approximately 1 week interval post operatively. At each visit a full orthoptist assessment was done including visual acuity, prism cover test at 1 meter, and assessment of binocular single vision using tests appropriate for the age. Other parameters were also recorded by orthoptist but have not been analyzed in this study. Eyes with alignment of 10 prism diopters of straight would be considered as straight and all the rest would be considered as misaligned.

RESULTS:

Total of 115 patients were analyzed pre-operatively. Out of these 92 patients (80%) were esotropic of which 63 (54.78%) were of unilateral esotropia and 29 (25.22%) were of alternating esotropia. Remaining 24(20%) were of exotropia of which 13 patients (11.30%) were of unilateral exotropia and remaining 11 (9.56%) were of alternating exotropia. Of these pre operative patients 54(46.91%) were males and 61(53.04%) were females. There were total of 35 patients up to 10 years of age(30.43%), from 10-16 years were 33(28.70%),from 16-25 years were 34(29.56%) and above 25 years were 13(11.30%) in number. Patients in whom complete post operative assessment was done were 95 in number and rest were lost in follow up.

Out of these 95 patients that have been assessed post operatively 85(89.47%) patients were having straight eyes at 1 week post operatively i.e., deviation within 10 prism diopters of straight, residual strabismus was found in 8 patients (8.42%) and consecutive squint was found in 2(2.11%) patients. Out of 115 patients, 38(33.04%) patients were having amblyopia.

DISCUSSION:

In our study total 115 patients of squint were examined. Out of them, 95 were post operatively examined. The frequency of Amblyopia was 33.04% (38) patients. The successful results of squint surgery were 89.47% (85) patients (having post operatively straight eyes). Residual squint was 8.42% (8) patients. 2.11% were having consecutive squint (2) patients.

Out of 115 patients, 54 (46.91 %) Patients were male and 61(53.04%) were female.

The success or failure of a surgical approach can’t be evaluated within a short follow-up period. The consecutive exotropia may not develop until years after the surgery for esotropia. However our study was based on short follow-up period.

Two patients had large angle esotropia and bilateral medial rectus recession was done and results were residual esotropia. In our study there were two patients (2.11%) with consecutive squint. According to a study the incidence of consecutive exotropia ranged from 4%9 to 20%10. A study done in Korea shows that consecutive esotropia developed in 13.8% of patients with immediate overcorrection of at least 17 PD.11 A study done in Department of Ophthalmology and Lions Eye Institute, Albany Medical College, Albany, New York USA shows 60% successful result (straight eyes) 32% residual esotropia and 8% consecutive exotropia.12 In our study (71.58%) were children. A study done in London shows infants undergo early surgical intervention, they have a chance of better alignment and stereopsis outcomes. Multiple surgeries may be needed.
to correct large angle of the esotropia. The number of
children requiring a second operation varies between
15-30%. 13

Another study done on comitant esotropia shows, close follow-up was required especially in cross fixating
children as amblyopia in one eye usually presents after
surgical alignment. 14

A study done on surgical management of residual
or recurrent esotropia shows that difference in surgical
response per millimeter of unilateral lateral rectus
resection were not significant. Bilateral lateral rectus
resection of 5, 6 and 7 mm resulted in a mean correction
of 19.75, 28.75 and 33.05 prism diopters, respectively. 15

A study done on bilateral lateral rectus resection
in patients with residual esotropia, showing successful
alignment in 68% under correction in 28% and
overcorrection in 4% cases, six month after surgery. 16

In our study the frequency of amblyopia was (33.04%)
which is quite different from, a study done in
Department of Ophthalmology, Postgraduate Institute
of Medical Education and Research, Chandigarh, India
shows the frequency of amblyopia were 61.3%. 17

CONCLUSION:
The study shows that most of patients with
unilateral squint were having amblyopia, with
frequency of 33.04%. The results of squint surgery were
good.

The ratio of female was greater than male. The
ratio of unilateral esotropia was greater than alternating
esotropia, and the ratio of esotropia was greater than
exotropia.

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INTRODUCTION

Congenital esotropia is one of the most common forms of strabismus, an ocular misalignment. Prevalence estimates of strabismus range from 1% to 6% in different populations, with esotropia reported five times more frequently than exotropia in a country like Ireland and twice as frequently in Australia. It represents more than half the ocular deviations in childhood. Congenital esotropia has been referred to as infantile esotropia or essential esotropia. Early onset (congenital, essential, infantile) esotropia is an idiopathic condition developing within the first six months of life in an otherwise normal infant with no significant refractive error and no limitations of ocular movements. Congenital esotropia never develops later than 6 months of age and more often develops at 2-3 months.

The misalignment is often readily apparent and the deviation is characteristically larger than 30 diopters. There is cross fixing in side gaze. The child uses left eye in right gaze and right eye in left gaze. Other than strabismus, children with congenital esotropia are usually normal.

The goal of treatment in congenital esotropia is to reduce the deviation to orthophoria or as close as possible. It is widely accepted that infantile esotropia is associated with severe deficits of stereopsis and fusion. The critical period of binocular visual development occurs around the first 4 to 6 months of life. The visual outcomes of patients with infantile esotropia are substantially improved if the misalignment is corrected surgically early in life. Recent reports suggest that early muscle surgery is associated with greater prevalence of stereopsis and fusion. Ideally, the eyes should be surgically aligned by the age of 12 months and at the latest by age of 2 year, but only after ambylopia or significant refractive errors have been corrected. The most common procedure is recession of both medial rectus muscles. The overall success rate with one operation was 83.5%.

There hardly exists any study pertaining to the success rate on the subject of surgical outcome for congenital esotropia. This study will help the result of bilateral medial rectus reurrences in all patients coming for treatment.

MATERIALS AND METHODS

This was a Quasi Experimental Study carried out at the Department of Ophthalmology, Jinnah Post Graduate Medical Centre, Karachi.
Graduate Medical Centre, Karachi for 6 months from February 2011 to August 2011. 53 patients were included in the study \[Z = \text{Level of confidence} : 95\%, P = \text{Prevalence of success rate} : 83.5\% (0.83), D = \text{Margin of error} : 10\% (0.10) \]. (Non-probability purposive sampling technique was used).

The patients coming to the squint clinic of Jinnah Post Graduate Medical Centre were selected on the basis of main complaints of ocular misalignment due to congenital esotropia (present by the age of 6 months) of either gender, were included in the study, while patients with previous extraocular or intraocular surgery, central nervous system abnormalities, organic eye disease and esotropia due to other causes were excluded. The informed written consent was taken from the subjects for the surgical correction and they were enrolled in the squint clinic for our study. All underwent a bilateral medial rectus recession by Parks cul-de-sac approach by experienced ophthalmologist. Patients were re-evaluated by the researcher one week and then one month post operatively. The results were interpreted in the light of postoperative prism cover test measurement as explained earlier. Final outcome was considered at the end of one month at which achievement of \( \leq 10 \) PD of residual esotropia was deemed as success. This information was entered in the performa attached. The database was analyzed on SPSS version 12.0 on computer. The groups of success (PD \( \leq 10 \)) and failure (PD \( > 10 \)) was compared by Fisher’s exact test or chi-square test. The age group of patients were stratified to know the confounding effect of these variables. The continuous variables such as age (in yrs) and degree of esotropia (in PD) pre and post operatively was presented as mean \( \pm SD \). The result were considered significant with \( P < 0.05 \).

**RESULTS**

53 patients were selected in the study, the age group of patients were between 1 to 27 years, with a mean age of 7.98 yrs and a standard deviation of 6.72. The male patients were 35 in number and the female patients were 18. The frequency of the male gender was 66\% out of the 53 patients and 34\% were females. On assessment with prism cover test, the preoperative degree of esotropia ranged between a minimum of 30 and maximum 95 prism diopters. The prism cover tests were done one week and one month postoperatively. The postoperative degree of esotropia after one week was a minimum of 5 diopters to a maximum of 25 prism diopters residual esotropia which has a mean of 9.72 and a standard deviation of 6.078. The results proved to become better after one month where most of the cases had a residual esotropia of 5 prism diopters. The maximum postoperative esotropia after one month was 25 and the mean being 9.06 with a standard deviation of 5.806. Amongst 53 patients 39 had a residual esotropia of less than 10 PD and this constitutes for an overall success rate of 73.6\% of the cases. 14 cases had a residual esotropia of more than 10 PD which was 26\% of the sample size and required a second stage surgery. The graphs consist of a comparison between preoperative degrees of esotropia and postoperative esotropia after one week as well as a comparison between degree of postoperative esotropia after one week and degree of postoperative esotropia after one month respectively.

**DISCUSSION**

Many studies have been conducted on surgical outcome on congenital esotropia. Several authors reported high rates of success, from 70 to 91\%, in large-angle congenital esotropia with large medial rectus recessions, and no significant adduction limitations.\(^{11,12}\)

Our study was conducted within a period of 6 months at Jinnah Postgraduate Medical Centre with a sample size of 53 patients. A study was conducted by Dr Lihua Wang in China. It consisted of a sample size
of 102 patients. His study was a retrospective study in which he collected data from a period of three years whereas we conducted a prospective study on all the cases which came to the squint clinic in Jinnah Postgraduate Medical Centre within a short period of six months.

In our study the preoperative degree of esotropia ranged between a minimum of 30 and maximum 95 prism diopters with a mean of 54.43. This is slightly less than preoperative degrees of esotropia seen in international studies. The study conducted by Tatiana Millán and Keila Monteiro in Brazil had preoperative degrees of esotropia ranging from minimum 40 prism diopters to a maximum of 100 prism diopters respectively with a mean deviation of 59.2. This difference in mean deviations in our study is probably due to anatomical and geographical differences between the two races.

The postoperative degree of esotropia after one week was a minimum of 5 diopters to a maximum of 25 prism diopters residual esotropia which has a mean of 9.72 and a standard deviation of 6.078. This is fairly better than the postoperative results seen in the study conducted by Tatiana Millán and Keila Monteiro which have a minimum postoperative degree of esotropia of 5 prism diopters and a maximum of 55 prism diopters and a mean of 16.11 with a standard deviation of 13.29. This may be due to the large angles of esotropia present in the patients of Tatiana and Keila’s study which leaves a greater degree of residual esotropia postoperatively. The difference in surgical techniques of the researchers may also play a vital role in the surgical outcomes.

The results of our study were proved to be better after one month postoperatively. Among the 53 patients 39 had a residual esotropia of less than 10 PD and this constitutes for an overall success rate of 73.6%. All this is consistent with results of other studies assessing term stability in surgical outcome and its affect on visual outcome. Additionally, this was a unicenter study with a small sample size of 53 patients. A multicenter study with a larger sample size and different surgical techniques could provide a better understanding of the possible surgical outcome.

Our study is unique in the sense it provides simple data on congenital esotropia surgical outcome that can be used by practitioners as a starting point for surgical decision making.

**CONCLUSION**

This study of surgical treatment of congenital esotropia revealed success rates in Karachi similar to those seen internationally, with satisfactory rates of orthotropia 6 months postoperatively. A further research on the exploration of binocularity seen in postoperative patients of congenital esotropia could be the objective of further research including more cases from the country’s tertiary and paediatric hospitals. Ideally, these institutions should participate in determining prevalence of congenital esotropia in Karachi and assessing surgical outcomes and other treatment options.

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Visual outcome of Ocular Trauma in patients of Rural & Urban areas managed at a Tertiary Eye Hospital

Munawar Ahmed FCPS¹, Muhammad Arshad Mahmood FCPS²
Muhammad Saeed FCPS³

ABSTRACT
Objective: To determine cause and type of ocular injury and visual outcome in urban and rural patients admitted for management of ocular trauma.

Study design: Observational clinical analysis

Setting and Period: Study conducted at a tertiary eye care center, between Nov: 2009 and Jan: 2012

Material and Methods: Independent randomly selected 104 patients of either sex having ocular trauma reported at eye department were registered and admitted. Detailed history was taken regarding cause, site, duration of injury, and area of residence. Complete ocular examination was carried out including visual acuity, slit lamp examination of anterior segment especially the area involved and posterior segment with 90 D if possible. After necessary investigations of admitted patients, surgical intervention was carried out. Final visual acuity was noted after removal of sutures. Follow up was done for three months.

Results: 88 subjects with average age of 18.43 years completed follow up of three months. Among these patients, male were 66 and female 22, rural 50, and urban 38. Closed globe injury was noted in 18 (20.4%) patients and open globe injury in 47 (53.4%), lid trauma 12 (13.6%), and periocular insult was found in 11 (12.5%) patients. Endophthalmitis occurred in 07 (14.89%) patients with open globe injury. Two children had bilateral eye injury due to fire cracker. Mean visual outcome in rural patients was 0.250(6/24) and 0.337(6/18) in urban. After management, vision improved in 77(87.5%) patients.

Conclusion: Ocular trauma was more common among rural population where commonest causes of eye injury were wooden stick, thorn and sickle. Open globe injury was the most common type of ocular trauma. The incidence of visual disability due to trauma can be reduced by education, awareness and better management.

Key Words: Management; Ocular injuries; Tertiary eye care center; Visual outcome.

INTRODUCTION
The eyes are exposed to external environment, hence vulnerable to trauma. Being delicate structure, minor force can result in big damage. Incidence of ocular injury varies in different countries. In Pakistan, hospital based data revealed that 9.54% of total ophthalmic admissions are due to ocular trauma. Victims of ocular trauma are predominantly males of younger age group who are unskilled and do not take preventive measures during their work. Delay in presentation, use of traditional eye medicine and lack of facility at primary health care level result in poor visual outcome. Mono-ocular trauma is most common².

According to WHO, blindness is defined as best corrected visual acuity less than 6/60 in better eye and visual impairment is defined as best corrected visual acuity less than 6/12 in better eye. It is estimated that approximately 55 million eyes suffer from ocular injuries every year worldwide, including 200,000 with open globe injury. About 1.6 million become blind, 2.3 million with bilateral low vision and almost 19 million with unilateral blindness or low vision. In America alone over 2.5 million people annually suffer from eye injuries.

In rural areas most frequently eye injuries are caused by wooden stick or thorn, where as in urban/industrial areas eye injuries occur in road accident or at work place. Factors which affect alertness or behavior can increase the incidence of ocular injury. Countries where alcohol is used in excess, ocular trauma is more common. Ocular injury is also more common in workers who are unskilled and do not take safety measures. Recovery of vision depends on site of entry wound, location of intra ocular foreign body and secondary retinal detachment. Results also depend on duration of trauma, severity of injury, intra ocular infection, and timely proper management. Ocular injuries in such
cases have unusual presentation and devastating visual results.

Ocular injury is more common in the rural residents where injury is usually related to agricultural work. In city area eye injury occurs during travelling or at work places. In both these areas, eye injury is more common in unskilled young persons. The commonest form of ocular insult is penetrating open globe injury. Younger age, male gender, addiction and lack of protective measures were the major risk factors for ocular trauma. The main purpose of this study was to identify the causes and type of eye injuries in rural and urban patients, to save sight with proper management, and put forward suggestions to control risk factors which lead to ocular injuries.

PATIENTS AND METHODS:

Independent randomly selected 104 patients (simple random sample) of either sex from 3 to 60 years of age having acute ocular injury were registered. The sample size for 95% confidence interval and reliability was calculated with formula \( N = \frac{(SD)^2}{SE} \) where \( N \) is sample size, \( SD \) is standard deviation and \( SE \) is standard error of the mean. Every patient with ocular injury was prospectively interviewed, examined, and admitted for management. History about pattern of work and preventive measures taken during work, any history of alcohol, drug, and tobacco or gutka addiction was also noted.

Inclusion criteria: Patients with ocular injury presented for the first time within 30 days of trauma were included in the study.

Exclusion criteria: Patients with history of previous treatment elsewhere, old ocular trauma, and with mild injury (corneal/conjunctival foreign bodies and abrasion) were not included in the study. Ocular trauma with severe head injury was also excluded from the study. Verbal / written consent was taken from the patients. In case of children counseling was done with the parents and consent obtained. The examination was done starting with name, age, sex, gender, residency, cause of ocular injury and duration.

Visual acuity was taken and if possible anterior and posterior segment examination was performed with slit lamp and 90D condensing lens. The intraocular pressure was taken in co-operative patients with closed globe injury. The site and extent of ocular trauma was localized on slit lamp. Necessary investigations like B-Scan ocular ultrasound and x-ray orbit was done in selected cases, complete blood count, and blood glucose levels were also performed. The photographic record of all the subjects was maintained before and after surgical intervention. The surgical repair was carried out as early as possible. Lid laceration and periocular injuries were sutured with 6/0 vicryl, scleral cuts with 8/0 absorbable suture and corneal wounds with 10/0 nylon. In case of severe corneal damage soft bandage contact lens was also applied after repair for one week.

Associated traumatic cataract was managed in selected cases during primary repair and in others after 3-4 weeks. Intravitreal injection of vancomycin and amikacin were given in case of endophthalmitis. Patients with retinal detachment or intravitreal foreign body were referred to vitreoretinal surgeon after primary repair. Skin sutures were removed after 7 days and corneal sutures were removed after 6 to 8 weeks depending on the wound condition.

Visual acuity and slit lamp examination was done on first post-operative day and on each follow up, on day seven, day fifteen, one month, two months and three months.

DATA ANALYSIS

SPSS 14.0 (Statistical Package for Social Sciences) was used for statistical analysis. Paired t-test was used to assess visual acuity in numbers of eyes before and after management of ocular injury in rural and urban patients. For data analysis visual acuity was used in decimals. Mean visual acuity before management was 0.1 and after management was 0.4, independent sample test was performed to see significant difference between urban and rural patients. There was no significant difference in visual outcome between urban and rural patients, P-value 0.281. However there was significant improvement in vision in both groups after management of ocular injury P-value 0.002. Mean difference between presenting and final visual outcome after management was 0.3. Standard deviation 0.19 and standard error mean 0.02.

RESULTS

Out of 104 registered patients 88 completed three months follow up. There were 66(75%) male and 22(25%) female patients, with male to female ratio of 3:1. The mean age was 18.43 years, ranging from 03 to 60 years. Rural patients were 50(56.8%) and urban 38

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<th>Features</th>
<th>No. of patients</th>
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<td>Total patients</td>
<td>88</td>
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<td>15 years and less</td>
<td>51</td>
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<td>Above 15 years</td>
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</tr>
<tr>
<td>Mean age (in years)</td>
<td>18.43</td>
</tr>
<tr>
<td>Range(in years)</td>
<td>3-60</td>
</tr>
<tr>
<td>Male</td>
<td>66</td>
</tr>
<tr>
<td>Female</td>
<td>22</td>
</tr>
<tr>
<td>Male to female ratio</td>
<td>3:1</td>
</tr>
<tr>
<td>Urban</td>
<td>38</td>
</tr>
<tr>
<td>Rural</td>
<td>50</td>
</tr>
<tr>
<td>Addicts</td>
<td>18</td>
</tr>
</tbody>
</table>
(43.18%). Demographic data is given in table 1. The most common cause of ocular injury was wooden stick; these patients were mainly from rural areas. The details of causes are mentioned in table no: 2.

Commonest type (53.41%) was open globe injury (penetrating, perforating, rupture). Patterns of ocular injuries are shown in table No 3. Notable associated findings of closed and open globe injury were traumatic cataract, hyphema, and optic nerve damage in some patients. Only 11(20.45%) patients took preventive measures like wearing helmet during driving and protective glasses during their work.

Over all at initial presentation, mean visual acuity was 0.1 (6/60) and final mean visual acuity after management was 0.4 (6/18). Average vision improved by three lines of Snellen’s chart. There was no significant difference in visual outcome between rural and urban patients, P-value 0.281. Average visual outcome was slightly better in urban patients by one line of snellen’s chart. Visual acuity before and after management is given in table no: 5.

### Table No: 2 Causes of Ocular Trauma n=88-

<table>
<thead>
<tr>
<th>Source</th>
<th>N/o eyes (%)</th>
<th>under 15yrs</th>
<th>above 15yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stick</td>
<td>18 (20.45%)</td>
<td>10</td>
<td>08</td>
</tr>
<tr>
<td>RTA</td>
<td>12 (13.63%)</td>
<td>05</td>
<td>07</td>
</tr>
<tr>
<td>Pencil</td>
<td>08 (09.09%)</td>
<td>07</td>
<td>01</td>
</tr>
<tr>
<td>Stone</td>
<td>07 (07.95%)</td>
<td>03</td>
<td>04</td>
</tr>
<tr>
<td>Fall</td>
<td>06 (06.81%)</td>
<td>04</td>
<td>02</td>
</tr>
<tr>
<td>Glass</td>
<td>05 (05.68%)</td>
<td>02</td>
<td>03</td>
</tr>
<tr>
<td>Knife</td>
<td>05 (05.68%)</td>
<td>04</td>
<td>01</td>
</tr>
<tr>
<td>Sickle</td>
<td>05 (05.68%)</td>
<td>04</td>
<td>01</td>
</tr>
<tr>
<td>Fire cracker</td>
<td>05 (05.68%)</td>
<td>04</td>
<td>01</td>
</tr>
<tr>
<td>Scissor</td>
<td>04 (04.54%)</td>
<td>03</td>
<td>01</td>
</tr>
<tr>
<td>Screw driver</td>
<td>03 (03.41%)</td>
<td>03</td>
<td>00</td>
</tr>
<tr>
<td>Finger nail</td>
<td>03 (03.41%)</td>
<td>02</td>
<td>01</td>
</tr>
<tr>
<td>Chisel iron piece</td>
<td>03 (03.41%)</td>
<td>00</td>
<td>03</td>
</tr>
<tr>
<td>Electric wire</td>
<td>02 (02.27%)</td>
<td>00</td>
<td>02</td>
</tr>
<tr>
<td>Fishing hook</td>
<td>01 (01.14%)</td>
<td>00</td>
<td>01</td>
</tr>
<tr>
<td>Gunshot</td>
<td>01 (01.14%)</td>
<td>00</td>
<td>01</td>
</tr>
<tr>
<td>Total</td>
<td>88</td>
<td>51</td>
<td>37</td>
</tr>
</tbody>
</table>

### Table No: 3 Pattern of Ocular Injuries n=88

<table>
<thead>
<tr>
<th>Type of injury</th>
<th>No of patients</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open globe</td>
<td>47</td>
<td>53.41</td>
</tr>
<tr>
<td>Closed globe</td>
<td>18</td>
<td>20.45</td>
</tr>
<tr>
<td>Lid cut</td>
<td>12</td>
<td>13.63</td>
</tr>
<tr>
<td>Periocular injury</td>
<td>11</td>
<td>12.50</td>
</tr>
</tbody>
</table>

### Table No: 4 Associated Findings of Ocular Trauma

<table>
<thead>
<tr>
<th>Type of injury</th>
<th>No. of Patients</th>
<th>Closed eye injuries No. of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iris prolapse</td>
<td>19</td>
<td>Cataract 07</td>
</tr>
<tr>
<td>Cataract</td>
<td>17</td>
<td>Hyphema 05</td>
</tr>
<tr>
<td>Hyphema</td>
<td>15</td>
<td>Vit: hemorrhage 03</td>
</tr>
<tr>
<td>Vit: hemorrhage</td>
<td>14</td>
<td>RD 01</td>
</tr>
<tr>
<td>Endophthalmitis</td>
<td>07</td>
<td>Glaucoma 01</td>
</tr>
<tr>
<td>Uveal prolapse</td>
<td>06</td>
<td>Iridodialysis 01</td>
</tr>
<tr>
<td>Optic Nerve damage</td>
<td>02</td>
<td>Macular edema 02</td>
</tr>
</tbody>
</table>

### Table No: 5 Visual Acuity Before and After Management n=88

<table>
<thead>
<tr>
<th>V/A Before management</th>
<th>No of patients</th>
<th>V/A After management</th>
<th>No of patients</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/6</td>
<td>04</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6/9 to 6/18</td>
<td>06</td>
<td>26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6/24 to 6/60</td>
<td>09</td>
<td>35</td>
<td>03</td>
<td>.002</td>
</tr>
<tr>
<td>CF</td>
<td>14</td>
<td></td>
<td>03</td>
<td></td>
</tr>
<tr>
<td>HM</td>
<td>18</td>
<td></td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>P1+</td>
<td>24</td>
<td></td>
<td>02</td>
<td></td>
</tr>
<tr>
<td>NPL</td>
<td>13</td>
<td></td>
<td>11</td>
<td></td>
</tr>
</tbody>
</table>

Note: Paired-ttest was used for visual acuity before and after management.

Endophthalmitis with open globe injury occurred in 07 (14.89%) patients. Only two children had bilateral eye injury due to fire cracker. Patients with 6/6 vision...
after trauma had periocular injury, where eye ball was not affected.

**DISCUSSION**

Trauma to the eyes is common in males of all ages but frequently occurs in younger and active age group including children. It causes great impact on vision and cosmetic appearance so patient shows much concern about it. In addition to being a public health problem, blindness and severe visual impairment resulting from the injuries have important socioeconomic implications. Because eye injuries affect young working persons, therefore it will affect their earnings for the whole life and rather than supporting will become a dependent person. Although ocular trauma is commonest cause of mono ocular blindness even then affected persons face difficulties in getting jobs. Equally important are indirect costs resulting from loss of productivity, hospital stay and initial anxiety of patients and parents. In case of visual disability the cost of rehabilitation and care are also tremendous.

The commonest cause of visual loss in our study was infection. Post-traumatic endophthalmitis is a catastrophic complication of penetrating eye injury which occurs mainly due to agricultural trauma, stones and intraocular foreign bodies. In one of the study, infection occurred in 36(10.9%) patients. In our study 19.31% resulted in blindness in effected eyes (VA less than 6/60). Loss of vision in these patients was due to endophthalmitis or optic nerve/retinal injury. Most of these patients reached hospital after four days.

The annual rate of hospitalized eye injuries in Australia is 25.5 per 100,000 population, 17% of these are penetrating. Males between 20-24 have higher rates of hospitalization than females and interpersonal violence is the most common type of injury mechanism (27.4%). The home is also the most common specified location of the incident and eye injuries were identified as work-related in 9.8% of cases. In our region rural women, working in agricultural lands receive ocular injuries; therefore male to female ratio is 3:1 in this region.

Cause or mechanism of injury and male to female ratio of ocular injuries may vary in different countries. The most common cause of eye injury in rural is by wooden stick which occurs during agricultural labor. Agricultural trauma is also common in rural areas of neighboring country. In one of the studies it was 46.9%. In our study one patient suffered from fire arm injury with loss of eye. However peoples of war affected areas of Pakistan do suffer from blast injuries to eye. After Afghanistan and Russian war, eye injuries due to mine blast resulted in 37.37% blindness and 47.1% were left with visual impairment.

Work related injuries also vary in different areas of Pakistan. In Khairpur and Turbat people receive injuries from leaves of date palms mainly during summer season when they take fruits. Most of the injuries of our patients are work related (agriculture/industries) or accidental. Penetrating ocular injuries were more common in our study, comparable to one study in Lahore.

Criminally negligent attitudes, lack of protective devices and playing of children with artificial weapons rather than with toys can make new generation more aggressive which will increase the incidence of ocular trauma. This attitude is more common in under-developed countries. In one study in Ghana ocular trauma in children result in blindness in 54.2% of cases.

The causes of eye injuries are also related to physical and psychosocial development. Children of younger age like to imitate adult behavior without the awareness of possible risks. School-aged children who are more physically active tend to take more risks to gain acceptance by their peers. Severity and type of injury are prognostic factors of final vision. Involvement of vital structures of eye ball in the anterior and posterior segment can jeopardize visual outcome or can even lead to blindness. Optimum management of trauma is related to improvement of visual recovery.

Ocular injury in our area is common in young unskilled persons or in those who do not take preventive measure during their work. In other countries eye injuries are common in persons who drink alcohol. Primary repair is possible in most of the cases with superficial damage with better visual outcome, while the severely damaged eyes require enucleation, microsurgical secondary repairs or vitreoretinal procedures. In our study we have not done any enucleation, severely damaged eyes were referred to vitreoretinal surgeon after primary repair.

Due to limited resources and lack of facilities at primary eye care level patients do not receive proper treatment well in time. Therefore patients from remote areas reach tertiary eye hospital late and many of them ignore follow up which affects results of treatment and problem in data collection.

Availability of treatment facilities at primary health care centers and prevention of ocular injuries are the mainstay of the management and various protective measures are advocated in the form of training, wearing protective clothes; protective eyewear and keeping safe working distance.

**CONCLUSION**
The incidence of ocular trauma is more among rural population mainly children, where agriculture related injury with wooden stick/ thorn or sickle is more common. In urban area the injuries are mostly related to kitchen job, mechanical work, or road accidents. In majority of cases the reason is negligence and unawareness.

RECOMMENDATIONS

1. Public awareness by using all means of media and teaching in schools
2. People at risk should wear protective eye wear.
3. Provision of better eye care services at the primary level.
4. One chapter relating to preventive measures must be included in the syllabus at school level

REFERENCES

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9. Eye, 2009; 23: 1234–1235
INTRODUCTION:
Retinal vein occlusion disease is estimated to be the second most common cause of retinal vascular disease.1 Macular edema is a frequent cause of visual acuity loss from branch retinal vein occlusion (BRVO). The Branch Vein Occlusion study demonstrated that argon laser photoocoagulation improved the visual outcome significantly in eyes with perfused BRVO of 3-18 months duration and reduced visual acuity of 20/40 to 20/200 due to macular edema. As the disease was seen to resolve spontaneously in one third of the patients, treatment was delayed for at least 3 months to permit maximum resorption of intra-retinal blood and edema.

During the last decade, anti-vascular endothelial growth factor (anti-VEGF) therapy evolved as a major treatment modality. The BRAVO study found intravitreal ranibizumab to be effective in the treatment of macular edema secondary to BRVO.2 However, no study has been done comparing the effectiveness of combination therapy of laser with ranibizumab with standard grid laser treatment alone in persistent macular edema secondary to BRVO. We believe that unlike with age-related macular degeneration (AMD) and Diabetic Retinopathy treatment, retinal vein occlusion (RVO) is an inner retinal disease, and a passive edema in the inner retina does not result in photoreceptor damage as rapidly as in AMD or DR, and there is lesser demand for frequent intravitreal injections. Moreover, as RVO is a result of acute process, unlike AMD and DR which are the result of chronic disease process, the treatment required will be less aggressive.

Hence, with the hypothesis in background that an injection of anti-VEGF further decreases the macular edema, allowing effective laser uptake at a lower power, a small, prospective, randomized, controlled trial was carried out to compare the safety and efficacy of intravitreal ranibizumab (0.5 mg/0.05 ml) as an adjunct to laser treatment with standard laser treatment in patients with visual impairment due to macular edema secondary to BRVO.

MATERIALS AND METHODS:
This is prospective, comparative study .The patients included had BRVO of at least 6 weeks duration, perfused as confirmed on fluorescein angiography, with central macular thickness (CMT) of ≥250 μm, and baseline visual acuity of 20/40 or worse.
Perfused BRVO was defined as lacking evidence of neovascularization in the retina or iris, with no obvious macular ischemia. The exclusion criteria were previous treatment for BRVO, such as intravitreal injection, subtenon injection, or laser photocoagulation, since the time of onset of BRVO, a history of glaucoma, macular edema secondary to other causes, such as age-related macular degeneration and diabetic retinopathy.

After obtaining an informed consent and explaining the treatment outcomes, the patients were randomized into three groups. The baseline characteristics of the patients in three groups were comparable as shown in Table 1. Group 1 received standard grid laser treatment alone. Group 2 received a single intravitreal injection of ranibizumab (Lucentis; Genentech, San Francisco, CA, USA) (0.5 mg / 0.05 ml) on Day 0 followed by grid laser treatment on Day 7, while Group 3 received three doses of intravitreal ranibizumab at monthly interval (i.e. 0, 1, and 2 months) with grid laser treatment on the 7th day following the first injection. At baseline, all the patients underwent a thorough ophthalmological examination, including best corrected visual acuity (BCVA) measurement with a Snellen chart and Early Treatment Diabetic Retinopathy (ETDRS) chart, applanation, tonometry, ophthalmoscopy, slit-lamp examination with 90D, fluorescein angiography, and optical coherence tomography.

For grid laser therapy, the guidelines followed were:
- Spot size: 50 - 100 μm
- Exposure: 0.05 - 0.1 second
- Burn intensity: Mild
- Number: As per areas of diffuse retinal thickening
- Placement: 1 - 2 burn-widths apart (500 - 3000 μm from center of fovea)
- Wavelength: Green

Eyes that were randomized into groups 2 and 3 received intravitreal ranibizumab (0.5 mg / 0.05 ml) under sterile conditions. After the injection, a topical antibiotic was applied and the patients were monitored for potential injection-related complications. The main parameters evaluated were BCVA and CMT on OCT at 1, 3, and 6 months after the initial injection. Fluorescein angiography was performed at baseline and at each monthly visit for 6 months. Blood pressure was measured at baseline and at each monthly visit.

Statistical analysis was performed using a commercially available statistical software package (SPSS for Windows, version 16.0; SPSS, Chicago, IL, USA). Visual acuity was converted into the logarithm of the minimum angle of resolution (logMAR) and decimal system for statistical calculations. Univariate categorical analysis was performed using the two-tailed t-test, Chi-square test, Mann Whitney U test, or Fisher’s exact test, as appropriate. The data were analyzed via repeated measures analysis of variance with a Bonferroni correction. The level of statistical significance was set at 0.05 (two sided) in all statistical tests.

### RESULTS:

#### Visual acuity outcomes

In Group 1, mean BCVA improved from 0.158±0.01 at baseline to 0.162±0.02 at 1 month, 0.192±0.01 at 3 months, and 0.289±0.01 at 6 months, i.e., there was a BCVA improvement of 11±3 letters at 1 month to 11.5±5 letters at 3 months and 12±5 letters at the end of 6 months (P = 0.05). In Group 2, the response was rapid after the intravitreal injection, with a mean BCVA improvement of 16±4 letters at 1 month from baseline (from 0.18±0.04 at baseline to 0.433±0.02 at 1 month). After 3 months, the mean BCVA improved by 17±5 letters (0.439±0.02), and at 6 months the gain increased to 17.5±5 letters (0.459±0.02) (P = 0.05). In Group 3, there was an average gain of 15.8±2 letters at the end of 1 month (from 0.144±0.02 at baseline to 0.306±0.02 at 1 month), which increased to 17.7±3 letters at the end of 3 months (0.338±0.02) and was sustained at 18±4 letters (0.432±0.02) at the end of 6 months (P = 0.05). Intergroup comparison for BCVA at months 1, 3, and 6 was not statically significant, but in Group 1, the mean improvement in BCVA of more than 3 lines was noted in only 10% of the patients as compared to 40% in Group 2.
2 and 30% in Group 3. A comparison of outcomes between the three groups is depicted in Figure 1.

**Imaging outcomes**

Paralleling the improvement in BCVA, ranibizumab treatment led to a rapid reduction in the (CMT). Similar responses were observed in single and triple dose regimens. In Group 1, center point thickness decreased from a mean of 500.2±141μm at baseline to 389.6±120μm at 1 month, 334.6±117μm at 3 months and 291.5±109μm at 6 months (P= 0.05). In Group 2 (single-dose regimen), there was a rapid decrease in mean CRT from 493.2±140μm at baseline to 230.3±96μm at 1 month, 200.3±92μm at 3 months that further decreased to 180.3±78μm at 6 months (P= 0.05). In Group 3, (triple dose regimen) mean CMT decreased from 515.7±126μm at baseline to 386.2±97μm at 1 month, 286.4±87μm at 3 months, and was sustained at 188.9±76μm at 6 months (P= 0.05). Though intergroup comparison results were not statically significant, at the end of 6 months, Group 1 showed a decrease in CMT of 208.7μm as compared to 312.9 and 326.8μm in groups 2 and 3, respectively. The changes in the mean OCT thickness in the three groups have been illustrated in Fig:2.

**DISCUSSION**

The natural history of macular edema secondary to BRVO was delineated in the Branch Vein Occlusion Study (BVOS). BVOS also demonstrated a benefit with grid photocoagulation in eyes with BRVO of 3-18 months duration and visual acuity of 20/40 to 20/200. Treated eyes were more likely to gain 2 lines of visual acuity (65%) compared with the untreated eyes (37%). Furthermore, treated eyes were more likely to have 20/40 or better vision at 3 years follow-up (60% vs. 34% untreated), with a mean visual acuity improvement of 1.3 lines ETDRS versus 0.2 lines in the untreated group.

The rationale for the use of anti VEGF to treat macular edema secondary to BRVO follows from the observation that the increase in retinal capillary permeability that results in macular edema may be caused by a breakdown of the blood retina barrier, mediated in part by VEGF, a 45-kDa glycoprotein. Therefore, attenuation of the effects of VEGF may reduce macular edema associated with BRVO. Anti VEGF has been demonstrated to bind and neutralize all the biologically active forms of VEGF, and therefore may be an effective therapy for macular edema.

The BRAVO trial (a phase 3, multicenter, randomized, sham injection-controlled study of the efficacy and safety of ranibizumab injection compared with sham in patients with macular edema secondary to BRVO) assessed the safety and efficacy of ranibizumab in patients with BRVO. Patients included in the study had macular edema involving the foveal center secondary to BRVO, central subfield macular thickness of 250 μm or greater on OCT, and BCVA of 20/40 to 20/400. Patients were randomly assigned to six monthly injections of ranibizumab, either 0.3 mg or 0.5 mg, or to sham injection. In 397 patients randomized, the mean gain from baseline at month 6 was 16.6 letters in patients receiving 0.3 mg of ranibizumab, 18.3 letters in those receiving 0.5 mg, and 7.3 in those receiving sham injections. By month 6, most patients in the two ranibizumab groups gained at least 3 lines of BCVA (55.2% in the 0.3 mg group and 61.1% in the 0.5 mg group), while most of those in the sham group did not (28.8%). This trial, however, enrolled all comers, irrespective of the duration of their disease.

We believe that as the disease was seen to resolve spontaneously in one-third of the patients in the BVOS study, treatment can be delayed for at least 6 weeks to permit maximum resorption of intra-retinal blood and edema. In this small, randomized, controlled study,
intravitreal ranibizumab at 4 weeks interval along with grid laser provided rapid and sustained improvement of BCVA in subjects with BRVO for 6 months period. 40% of the subjects gained at least 3 lines of vision in 24 weeks. The rapid improvement in vision was paralleled by reductions in macular thickness. Almost similar improvements were observed in the single and the triple dose groups.

It is our belief that the endpoint gain in BCVA would be greater if an anti-VEGF is used prior to laser therapy. Anti-VEGF would decrease the macular thickness, allowing effective laser uptake at a lower power. The results in Groups 2 and 3 of our study illustrate this point (as 70% of the treated eyes gained and maintained 2 or more lines of BCVA from baseline).

In BRAVO study, after six doses of intravitreal ranibizumab at the end of 6 months, there was a gain of 16.6 letters and 18.3 letters and the mean changes in CMT were 337.2 and 345.2 μm in 0.3 and 0.5 mg groups, respectively. Although a direct comparison cannot be made because of difference in the study design, it is worth while noting that in our study the mean improvement in BCVA was 17.5 letters in Group 2 and 18 letters in Group 3 at the end of 6 months. Similarly, a decrease in CRT of 312.9 and 326.8 μm in groups 2 and 3, respectively was noted.

CONCLUSION:
In our study design, though no significant difference for a gain in BCVA was noted in the three treatment groups, the fact that gain in BCVA of more than 3 lines was noted in 40% patients of combination therapy compared to 10% patient in standard laser group helped us conclude that ranibizumab may be used as an effective and safe adjunct to laser in the treatment of macular edema secondary to BRVO. Since economics plays a major role in treatment involving anti-VEGF administration, this alternative treatment modality may prove to be a viable option in the developing countries.

Limitation of this study includes the small study population. Despite this limitation, the results of this study suggest that intravitreal ranibizumab is an effective option for the treatment of BRVO and that larger, more definitive, randomized clinical trial are warranted to determine the optimal treatment interval and duration.

REFERENCES:

Mushtaq Ahmad FCPS¹, Muhammad Naeem², Lal Muhammad FCPS³

ABSTRACT

Purpose: To compare the safety and efficacy of subtenon anaesthesia with peribulbar anaesthesia in manual small incision cataract surgery using a randomised control clinical trial.

Material & Method: Ninety patients were randomized to subtenon and peribulbar groups with preset criteria after informed consent. All surgeries were performed by a single surgeon. Pain during administration of anaesthesia, during surgery and 4 hour after surgery was graded on a visual analogue pain scale and compared for both the techniques. Sub-conjuntival haemorrhage, chemosis, akinesia after administration of anaesthesia and positive pressure during surgery were also compared. Patients were followed up for 6 weeks postoperatively. Results: About 76/90 (86.66%) patients completed the six-week follow-up. Fifteen out of 45 (33.33%) patients of peribulbar group and thirty four out of 45 (75.55%) patients of subtenon group experienced no pain during administration of anaesthesia. There was no significant difference in pain during and 4 hour after surgery. Subtenon group had slightly more subconjuntival haemorrhage. About 32(71.11%) patients of the peribulbar group had absolute akinesia during surgery as compared to none (0%) in sub-tenon group. There was no difference in intraoperative and postoperative complications and final visual acuity.

Conclusion: Sub-tenon anaesthesia is safe and as effective as peribulbar anaesthesia and is more comfortable to the patient at the time of administration.

Keywords: manual small incision cataract surgery; peribulbar anaesthesia; sub-tenon anaesthesia

INTRODUCTION

Cataract is the main and biggest cause of curable blindness worldwide¹. Cataract extractions is one of the most cost-effective of all surgical interventions in terms of quality of life restored. The only treatment option for cataract is the surgical removal of the opaque lens and the implantation of an artificial lens.² Peribulbar anaesthesia for cataract surgery was the most popular technique in the previous decade³ but it is not completely free from complications.⁴ Retrobulbar anaesthesia, which was used for almost a century, was associated with a number of potentially sight-threatening complications.⁵ Alternative anaesthesia procedures have been developed to reduce the risk of injuring intraorbital structures ⁶,⁷,⁸. Advances in cataract surgery including the use of a smaller, self-sealing incision have shortened the duration of surgery resulting in the use of shorter acting anaesthetic agents with less invasive methods of administration.⁹ Subtenon anaesthesia¹⁰ involves trans-conjunctival infiltration of local anaesthetic agent directly to the subtenons space, after instillation of local anaesthetic drop in the conjunctiva which takes away the pain from, the needle prick. This technique has been used for conventional extracapsular cataract extraction (ECCE) with posterior chamber intraocular lens implantation (PCIOl) and phacoemulsification¹¹. Manual small incision cataract surgery (MSICS) has become popular in developing countries as it gives better uncorrected vision as compared to ECCE¹² and at an affordable cost. A comparison of subtenon anaesthesia with the more popular peribulbar anaesthesia for MSICS could not be found by us in the literature. The study aimed to compare the two methods of anaesthesia in MSICS with respect to pain, akinesia, intraocular pressure control, surgeon’s comfort and complications, using a randomised control clinical trial.

MATERIALS AND METHODS

All the patients admitted for cataract surgery, were asked to participate in the trial. The first 90, who agreed to informed consent, were randomised to either subtenon or peribulbar technique.

The exclusion criteria were:
1. Age < 30 or > 90 years

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2. Sensitivity to Xylocaine
3. History of convulsion, epilepsy
4. Inability to give informed consent
5. People who preferred phacoemulcification or conventional extracapsular surgery
6. Previous intraocular injury, inflammation or surgery
7. Pupil <5 mm in diameter
8. Inability to understand the visual analogue pain scale.

Assuming 90% power and 5% level of significance and assuming that there would be no pain in 40% and 60% of cases by either technique (difference of proportions), each arm should have a minimum of 31 patients. Assuming loss of 20% to follow-up, the study aimed to randomize at least 77 patients. Permission was obtained from the ethical committee of the hospital. Both techniques of anaesthesia are acceptable standards of care and have been in use for more than a decade. The consent form and information sheets for the patients were designed as per the Helsinki protocol guide lines and translated into urdu. Informed consent was obtained from all the patients who participated. Each patient was randomly assigned by opening an envelope on entering the recovery (pre-anaesthetic) room. The peribulbar anaesthesia was administered by the anaesthetist and the subtenon anaesthesia was given by the surgeon on table. Any extra anaesthetic needed was noted. The patients and the surgeon were masked till 10 min before surgery. The patient was asked to gauge for the pain during administration of the anaesthetic, pain during surgery and after it was completed. Postoperative pain after 4 h was also recorded. After each surgery the surgeon was asked to score for akinesia and to grade for positive pressure during surgery, chemosis, subconjunctival haemorrhage and overall discomfort. Intraoperative complications were noted. All patients underwent MSICS; any change in technique, if needed, was noted. The patients were followed on the first postoperative day, first week and sixth week after surgery. The postoperative complications were noted, as also the best corrected postoperative visual acuity and refraction. The eye to be operated was painted with povidone iodine. After draping, a lid speculum was applied and two drops of topical 4% lignocaine were instilled.

Conjunctival forceps were used to grip the conjunctiva and a curved subtenon cannula was then inserted on to bare sclera and glided along the contour of the globe. One ml of 2% lignocaine with 1:10 000 adrenaline was injected slowly in the posterior subtenon space. Technique of peribulbar anaesthesia was, four ml of 2% lignocaine with 1:10 000 adrenaline was injected using a 24G needle at junction of middle and outer third of the lower orbital margin with the needle directed towards floor of orbit. A supplementary injection of 1 ml was given at the supra orbital notch. The eyelid was then closed and pressure was applied for 5 min. Visual analog pain scale used to grade the pain they felt on a linear scale of 0-4.

No pain = grade 0,
Mild pain = grade 1,
Moderate pain = grade 2,
Severe pain = grade 3 and
Maximum pain imaginable = grade 4.

Patients were asked to grade separately for pain during administration of anaesthesia, pain during surgery and pain 4 h after surgery. The last was taken when the patient was shifted to the wards. The ophthalmologists also graded for chemosis, subconjunctival haemorrhage after administration of anaesthesia and positive pressure during surgery on a scale of 0-4, of increasing severity. ‘Akinesia’ was scored on a scale designed to measure ocular movements in each quadrant (no movement = score 0, mild = 1, moderate = 2, severe = 3 in each quadrant, minimum score possible = 0, maximum score possible = 3 x 4 = 12). The surgeon also graded for the ‘discomfort’ he felt during surgery (grade 0 = no discomfort, grade 1 = mild discomfort, grade 2 = moderate, grade 3 = severe, grade 4 = surgery not possible).

RESULTS

About 78/90(86.66%) patients completed the six-week follow-up. About 90 patients underwent MSICS between July 2010 to June 2011 and were operated upon by a single surgeon. 25/45(55.55%) were males, in peribulbar group and 27/45(60.00%) in the subtenon group. Average age in the two groups was 58 and 56 years, respectively. There was no statistically significant difference between the two groups with respect to age (p = 0.133) and sex. (p = 0.213). The various grades of pains during anaesthesia are depicted in Table -1. Chi square test shows that there is a significant difference between both the groups with regards to pain on administration of the anaesthesia for grades 0 and 1 (p< 0.0001). p = 0.09 for grade 2, p = 2 for grade 3 by figure exact test, there being no statistically significant difference for grade 2 or more. The average for pain during anaesthesia was grade 0.82 for the peribulbar group and 0.26 for subtenon group on a range of 0-4. Table - 2 shows the various grades of pain during surgery in both the groups. Average for pain during surgery was 0.15 for peribulbar and 0.07 for subtenon on a range 0-4. Table -3 describes the various scores of ocular movement after anaesthesia. 43 out of 45(95.5%) of patients in peribulbar group had scores of 4 or less; 41/45(91.1%) of patients of subtenon group scores of 6.
or more, with the mode score of 10. The mode for peribulbar group was 0. This was statistically very significant ($p<0.0001$). Average score for akinesia was 1.2 in peribulbar group and 8.4 in subtenon group on a range 0-12. About 45/45 (100%) patients of peribulbar group and 44/45 (97.7%) patients of subtenon group did not have any positive pressure during surgery. Only one patient of subtenon group had minimal pressure rise. Various grades of subconjunctival haemorrhage in both the groups is described in Table - 4 whereas Table - 5 describes various grades of conjunctival chemosis in both the groups. In 43/45 (95.5%) surgeries under peribulbar anaesthesia and in 39/45 (86.6%) surgeries under subtenon anaesthesia, the surgeons experienced no discomfort. All patients of the peribulbar group (45/45) reported no pain for 4 hours after surgery compared to (44/45) patients in the subtenon group. There were two posterior capsular rents in the peribulbar group. One patient in the subtenon group had button holing during scleral tunnel creation. The incidence of postoperative complication in both arms was similar. There was no significant difference in both the groups with regards to uncorrected and corrected visual acuity after 6 weeks postoperatively. 42/45 (93.3%) of patients in peribulbar group and 41/45 (91.1%) in subtenon group had postoperative corrected visual acuity >6/9. No patient had visual acuity less than 6/60. One patient in the peribulbar group needed additional anaesthesia of 3cm$^3$ of 2% xylocaine. One MSICS in subtenon group was converted to ECCE due to difficulty in delivering the nucleus.

**DISCUSSION**

Subtenon anaesthesia was more comfortable for the patient at the time of anaesthetic administration. They also had good analgesia intraoperatively, but the surgeons had to operate with incomplete akinesia, which some may find discomfiting. The incidence of subconjunctival haemorrhage was also slightly more as compared to the peribulbar group. The surgery was started immediately after administration of anaesthesia in subtenon group. As lesser amount of the anaesthetic agent was used for subtenon, the chances of adverse effects are also minimized. In a large hospital or in a community eye care setting, the cost would also be less.

<table>
<thead>
<tr>
<th>Table 1: Pain during anesthesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akinesia</td>
</tr>
<tr>
<td>Grade 0 (no pain)</td>
</tr>
<tr>
<td>Grade 1 (mild pain)</td>
</tr>
<tr>
<td>Grade 2 (moderate)</td>
</tr>
<tr>
<td>Grade 3 (severe)</td>
</tr>
<tr>
<td>Grade 4 (max imaginable)</td>
</tr>
<tr>
<td>Total</td>
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CI: Confidence Interval

<table>
<thead>
<tr>
<th>Table 2: Pain during surgery</th>
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</thead>
<tbody>
<tr>
<td>Akinesia</td>
</tr>
<tr>
<td>Grade 0 (no pain)</td>
</tr>
<tr>
<td>Grade 1 (mild pain)</td>
</tr>
<tr>
<td>Grade 2 (moderate)</td>
</tr>
<tr>
<td>Grade 3 (severe)</td>
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<tr>
<td>Grade 4 (max imaginable)</td>
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<tr>
<td>Total</td>
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</table>

CI: Confidence Interval

<table>
<thead>
<tr>
<th>Table 3: Ocular movements during surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akinesia</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>8</td>
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<tr>
<td>10</td>
</tr>
<tr>
<td>12</td>
</tr>
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<td>Total</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 4: Subconjunctival haemorrhage after administration of anesthesia</th>
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</thead>
<tbody>
<tr>
<td>Subconjunctival haemorrhage</td>
</tr>
<tr>
<td>Grade 0</td>
</tr>
<tr>
<td>Grade 1</td>
</tr>
<tr>
<td>Grade 2</td>
</tr>
<tr>
<td>Grade 3</td>
</tr>
<tr>
<td>Grade 4</td>
</tr>
<tr>
<td>Total</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 5: Chemosis after administration of anesthesia</th>
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</thead>
<tbody>
<tr>
<td>Chemosis</td>
</tr>
<tr>
<td>Grade 0</td>
</tr>
<tr>
<td>Grade 1</td>
</tr>
<tr>
<td>Grade 2</td>
</tr>
<tr>
<td>Grade 3</td>
</tr>
<tr>
<td>Grade 4</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>
There was no difference in chemosis, positive pressure rise during surgery and postoperative pain between both the techniques of anaesthesia. An audit of subtenon and peribulbar anaesthesia for cataract surgery in UK demonstrated sub-Tenon’s methods to be more effective than the peribulbar technique, with significantly fewer patients experiencing unacceptable levels of pain.10 It was significantly less uncomfortable on administration than the peribulbar methods and reduced the interval between administration of anaesthesia and surgery. On the range of 1-10, pain on administration of anaesthetic had a mean of 2.4 for the peribulbar group and 1.4 for the subtenon group. This correlated with results of our study. The subtenon technique appeared to be the safest method of introducing anaesthetic fluid into the retrobulbar space without the potential complication of a sharp needle injection.11 But a single case of globe perforation was reported14 in a patient who had underwent detachment surgery and had thinned sclera. It is likely that subtenons anaesthesia offers a significantly reduced risk of complication such as scleral perforation, retro bulbar haemorrhage, optic nerve injury and injection of anaesthetic solution into the subarachnoid space, as no sharp instrument is passed into the orbit. It should, however, be used with caution in patients with compromised sclera. A randomised study in Denmark comparing retrobulbar, subtenon and topical anaesthesia for phacoemulcification found retrobulbar techniques had less discomfort/pain during surgery but patient preferred subtenon or topical anaesthesia, as it did not involve the needle prick during anaesthesia.12 Subtenon anaesthesia has also been used for optic nerve sheath fenestration.13 Subtenon anaesthesia has been found to be more comfortable for the patient, reliable, long lasting and with deeper anaesthesia as compared to topical anaesthesia for phacoemulcification patients. It was also more comfortable for the surgeon with better pupillary dilatation.16 A randomised trial in the UK17 found the difference between the pain score in the subtenon and topical groups to be highly statistically significant, with subtenon being more pain free, for phacoemulcification patients. Limitations of the study include subjective nature of the visual analog pain scales and that the field testing or optic nerve damage analysis was not done. But past studies and postoperative visual acuity results indicate that it would not be significant.

CONCLUSION

The subtenon’s technique for administration of anaesthesia during MSICS is as safe as the peribulbar technique giving equally good analgesia during and after the surgery. It is recommended as a safe and effective alternative to peribulbar anaesthesia for MSICS.

REFERENCES


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INTRODUCTION
Cataract in childhood is the most significant cause of visual impairment and blindness. Diminution of vision in early years of life, can adversely affect overall development of child with far reaching effects on personal, educational, work-related and social aspects.\(^1\) As a result early recognition and treatment is very crucial for maximizing visual development.\(^2\) Treatment of congenital/developmental cataract poses a dare to ophthalmic society, patients and parents in terms of treatment, visual development and visual rehabilitation of these patients.\(^3\) Advances and development of new microsurgical techniques and amblyopic management have improved the safety and usefulness of pediatric cataract treatment.\(^4,5\) On the other hand, management of congenital cataracts remains a challenge as postoperative complications are still common.\(^6,7\) One of the most common causes of decreased vision after cataract surgery especially in unilateral cataracts is amblyopia, which is an extremely difficult to manage, and need extreme motivation to do so.

In this study we have tried to find out the effectiveness of cataract surgery in children with unilateral cataract and causes of decreased vision if present after the surgery. We also evaluated the frequency of amblyopia development after unilateral cataract and the effectiveness of its management with amblyopia therapy.

MATERIAL AND METHODS
A total of 410 successive children aged 2-10 years with unilateral cataract treated and followed up at our institution between March 1st, 2010 and March 30th, 2012, were included in this prospective study. The study was done at Al-Ibrahim Eye Hospital, Karachi. Informed consent was taken from the guardians of the patients included in the study. Patients with visually significant cataract, and needing cataract surgery were included in the study while patients who had ocular infection, previous ocular surgery and prematurity or other systemic diseases making it impossible to undergo general anesthesia, were excluded from the study. All those patients who were selected underwent relevant investigations, ophthalmic checkup including visual acuity, slit lamp examination, fundus examination, retinoscopy, keratometry, B-scan ultrasonography and intra ocular lens power calculation wherever possible were done. Intra ocular lens power was calculated by using SRK II formula. Dilatation of pupil was done with cyclopentolate 1% at 90, 60, 30 and 15 minutes preoperatively. Surgical procedure includes irrigation and aspiration with wide anterior capsulotomy.
Primary posterior capsulotomy and anterior vitrectomy was done in all eyes. In children with bilateral lens opacities requiring surgery and the eyes with poorer vision was operated first and surgery for second eye was performed three weeks later. All cases remained on topical steroids eye drops for six weeks. Patients were followed one day and one week for early postoperative complications. Patients were also followed after 1 month and 2 months. Visual acuity was checked on the follow up after 1 month, especially those patients who had started on amblyopia therapy. All those patients undergoing therapy were followed every two weeks. Final outcome was considered after 3 months of therapy. Visual acuity was compared with the visual acuity before amblyopia therapy (occlusion of the good eye). Visual acuity was evaluated using the Teller Acuity Cards Test or the Lea Test depending on the age and with one eye occluded. All refraction readings were taken after instillation of cyclopentolate 1%.

Data analysis was done using SPSS version 19. Frequencies of gender, age, and complications were recorded. Statistical analysis of the frequency of several postoperative complications was performed by the Fisher exact test. All tests were two-tailed, and acceptable significance was recorded when P values were less than 0.05. Paired t test will be used to compare the visual acuity before and after amblyopic therapy.

RESULTS

A total number of 410 patients were included in the study. Minimum age of the patient included in the study was 2 months while the maximum age was 10 years, with mean age of 67.23 (standard deviation=56.4). Out of 410 patients, 251 (61.2%) were male while 159 (38.8%) were female. Different types of cataracts were observed during the study, congenital cataract was the most frequent among all the other types of cataracts seen. Multiple associated features were also observed along with cataract in the patients, most common of these were nystagmus, which was seen in 30 patients. Other common associated features and their frequencies are shown in table-1. Right eye was involved in 211 patients, while left eye was involved in 199 patients. The comparison of pre-surgical and post-surgical visual acuity is in (Fig. 1). Amblyopia was the most frequent cause of decreased vision among the patients with best corrected visual acuity less than 6/18, other causes (table 2). Amblyopia was seen in 214 (52.2%) of patients. Best corrected visual acuity before and after amblyopic therapy (Fig. 2). 148 (69.15%) patients out of 214 patients who were given amblyopic therapy showed improvement in visual acuity (Fig. 3).

DISCUSSION

In this study, we have tried to share our experience of managing after pediatric cataract. A significant (p<0.05) improvement in visual acuity was observed after cataract surgery. Most frequent cause of decrease vision after cataract surgery was amblyopia, which was managed by occlusion therapy. A significant (p<0.05) improvement in visual acuity was observed after occlusion therapy. We also tried to find out the possible causes of cataract development among children, and we observed that congenital cataract was the most common type of cataract followed by traumatic cataract.

Amblyopia a common cause of decreased vision in children after unilateral cataract and has been reported in many studies.8-10 In our study we also

### Table 1: Multiple Associated Features along with Cataract

<table>
<thead>
<tr>
<th>Associated Features</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nystagmus</td>
<td>30</td>
</tr>
<tr>
<td>Microphthalmos</td>
<td>10</td>
</tr>
<tr>
<td>Corneal Opacity</td>
<td>16</td>
</tr>
<tr>
<td>Retinal Pathology</td>
<td>2</td>
</tr>
<tr>
<td>Subluxated Lens</td>
<td>20</td>
</tr>
<tr>
<td>Ruptured Lens Capsule</td>
<td>8</td>
</tr>
<tr>
<td>Corneal tear</td>
<td>2</td>
</tr>
<tr>
<td>Corneal edema</td>
<td>2</td>
</tr>
<tr>
<td>Micro Cornea</td>
<td>4</td>
</tr>
<tr>
<td>Esotropia</td>
<td>6</td>
</tr>
</tbody>
</table>

### Table 2: Causes of Decreased Vision Post Operatively (VA < 6/18)

<table>
<thead>
<tr>
<th>Causes</th>
<th>Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amblyopia</td>
<td>214</td>
</tr>
<tr>
<td>Uveitis</td>
<td>2</td>
</tr>
<tr>
<td>Retinal scar</td>
<td>5</td>
</tr>
<tr>
<td>Corneal opacities</td>
<td>6</td>
</tr>
<tr>
<td>Others</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>210</td>
</tr>
</tbody>
</table>

VA= visual acuity
HM= hand movement
FC= finger counting
PL= perception of light
noticed that the most frequent cause of decreased vision postoperatively. It might be defined as interference of visual acuity development caused by short of stimuli or insufficient stimuli during critical periods of development. It can be classified as strabismic, anisometropic or sensory deprivation due to congenital cataracts. The treatment of infantile cataract is based on two major approaches: surgical removal of the opacified lens and optical therapy. Optical therapy or rehabilitation can be achieved with intraocular lens (IOL) implantation plus optical correction or optical correction without IOL implant. There are many ways of treating after sensory deprivation which includes first removing the cause of sensory deprivation, afterwards, either occlusion therapy or penalization could be performed. In our study we used the method of occlusion. We gave training to the parents for one week when they started occlusion therapy along with the counseling regarding the importance of this therapy. As a result 69% of the children had improvement of a single line or more after they underwent this occlusion therapy. Patching therapy was prescribed after optical correction our study used the following scheme of patching children between 2-4 months of age (patching the fellow eye 2-4 hours/day), children between 4-6 months of age (patching the fellow eye 4-6 hours/day), children older than 6 months (patching 50% of the day). As all the patients in our study were older than 6 months we guided them to do the patching for 50% of the day. Outcome of therapy was largely dependent on the compliance of the therapy. We assessed compliance on the basis of information given by the parents. If child underwent occlusion therapy daily and almost fully as desired it was rated as excellent, while if the child underwent occlusion daily but not up to the hours desired it was rated as good to fair. But if child skipped days between the therapies it was rated as poor compliance. We noted that highest number of children who were rated as excellent in compliance showed improvement in visual acuity. On the other hand children rated with poor compliance showed negligible improvement in the visual acuity. Further research will be required to investigate the ideal timing in pediatric cataract surgery and hence prevention in the development of amblyopia.

CONCLUSION
Congenital cataract is the most common type of cataract seen in children, and it is along with other type of cataracts can be successfully managed by performing surgery, resulting in good visual improvement and prevention in amblyopia.

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11. Hassan M, Qidwai U. Complication and Visual Outcome after Pediatric Cataract Surgery with or Without Intra Ocular Lens Implantation, Pak J Ophthalmol 2011, Vol. 27 No. 1
Incidence of Pupillary Involvement, Course of Anisocoria & Ophthalmoplegia in Diabetic Oculomotor Nerve Palsy

Naveed Ahmad Shah1, Iftikhar Ahmad2, Abdul Ghafoor3

ABSTRACT:

Aims: To derive a reliable estimate of the frequency of pupillary involvement and to study the patterns and course of anisocoria in conjunction with ophthalmoplegia in diabetes-associated oculomotor nerve palsy.

Materials and Methods: In this prospective analytical study, standardized enrolment criteria were employed to identify 35 consecutive patients with diabetes-associated oculomotor nerve palsy who were subjected to a comprehensive ocular examination. Standardized methods were used to evaluate pupil size, shape, and reflexes. The degree of anisocoria, if present and the degree of ophthalmoplegia was recorded at each visit.

Results: Pupillary involvement was found to be present in 25.7% of the total number of subjects with diabetic oculomotor nerve palsy. The measure of anisocoria was < 2 mm, and pupil was variably reactive at least to some extent in all cases with pupillary involvement. Majority of patients in both the pupil-involved and pupil-spared group showed a regressive pattern of ophthalmoplegia, reversed much earlier and more significantly when compared to anisocoria.

Conclusions: Pupillary involvement in diabetes-associated oculomotor nerve palsy occurs in about 1/4 th of all cases. Certain characteristics of the pupil help us to differentiate an ischemic insult from an aneurysmal injury to the 3rd nerve. Ophthalmoplegia resolves much earlier than anisocoria in diabetic oculomotor nerve palsies.

Keywords: Anisocoria, diabetic oculomotor nerve palsy, ophthalmoplegia

INTRODUCTION

Diabetics are predisposed to certain acute mononeuropathies, including cranial neuropathies, which could involve oculomotor nerves. The oculomotor nerve is quite commonly involved in diabetes.1,2

The size and reactivity of the ipsilateral pupil is generally considered a useful guide to help clinicians distinguish oculomotor nerve injury, caused by aneurysmal compression (dilated and poorly reacting pupil) from peripheral nerve infarction in which the pupil is usually spared.3,4,5

While pupil involvement is a sensitive predictor of aneurysmal compression, the specificity of this sign remains less clear in regard to diabetes-associated infarction. In the recent past, it has been noted that more patients present with pupillary involvement in diabetes-associated oculomotor nerve palsy. Similarly, there have been incidences of oculomotor nerve palsy associated with aneurysms but presenting with sparing of the pupil. As oculomotor nerve palsy caused by posterior communicating artery aneurysm can lead to devastating outcomes, a dilemma arises in patients with pupil involving oculomotor nerve palsies with diabetes. The reported frequency of pupil involvement based on retrospective analysis ranges from 14% to 32%.1,3,6,7,8 The purpose of this study was to derive a more reliable estimate of the frequency of pupil involvement and to study the course of anisocoria and ophthalmoplegia in patients with diabetes-associated oculomotor nerve palsy. Finding the correct incidence could help in deciding the need for extensive investigative procedures like an MRI brain.

MATERIALS AND METHODS:

The study population consisted of 35 consecutive patients with diabetes-associated oculomotor nerve palsy. All patients with oculomotor nerve palsy due to diabetes as diagnosed clinically and documented appropriately with Hess charting and diplopia charting were recruited for the study. Other conditions such as head trauma, compressive lesions, intracranial aneurysm, space occupying lesions, carotid-cavernous fistula, vasculitic infarction such as giant cell arteritis, meningeal inflammation, herpes zoster, cavernous sinus thrombosis, ophthalmoplegic migraine and post-viral demyelination were excluded from the study. Similarly, patients with oculomotor nerve palsy due to diabetes along with one or more of the above-mentioned conditions were also excluded.

A detailed medical history and past history of the subjects was taken. All patients were subjected to a comprehensive ocular examination, which included visual acuity and slit lamp biomicroscopy. Particular
attention was paid towards lid examination, pupillary reflexes, and extraocular movements.

Ptosis, if present, was graded. Pupils were checked for size, shape, and light reflexes. Pupillary involvement was scrutinized by measuring the pupil size and its reactivity to light. Standardized methods were used to measure pupil size. Patients were instructed to look at a target kept 6 meters away under stable room light conditions. A pupil gauge accurate to within 0.5 mm was used to measure the pupil diameters. The patients were engaged in conversation to ensure that they were alert. The degree of anisocoria, if present, was recorded.

Anisocoria, if present, was again measured under dim light conditions to rule out simple (physiological) anisocoria. An anisocoria was termed as simple if it remained similar in room light as well as in dim light. The quality of direct pupillary light reaction was also recorded.

Hess charting and diplopia charting were done in all cases to confirm oculomotor nerve palsy. Standardized method to quantify the degree of ophthalmoplegia by recording the relative limitation of ocular ductions of the superior, inferior, medial recti muscles and inferior oblique using a 0 to 4 scale was used.0 0 represented full duction; 4 complete absence of function; and 1, 2 and 3, 25%, 50% and 75% impairment of duction, respectively. A single ophthalmoplegia grade was determined by calculating the arithmetic mean of the relative limitation of ocular ductions of the involved 4 muscles.

Patients were subjected to a fundus examination with a 78 D lens to document any signs of diabetic retinopathy. MRI of brain were done in all cases to rule out surgical lesions. Blood pressure measurement, random blood sugar, erythrocyte sedimentation rate and serum cholesterol were recorded in all cases. They were treated with oral methylcobalamin.10 They were advised to control diabetes and other associated systemic disorders and to undergo ocular physiotherapy. They were reviewed again after 2 weeks and 8 weeks from the baseline visit. Lid position, extraocular movements, pupil size, and reaction to light were recorded at every visit.

The data collected from the patients were coded and tabulated. Appropriate inferential, descriptive statistics, analysis of variance (ANOVA), and correlation were compiled using Statistical Package for the Social Sciences (SPSS) version 17. The results of the analysis were presented in the form of tables and graphs. The statistical significance is tested at 5% level (P < 0.05).

RESULTS:

Of the total 35 subjects screened, none had bilateral oculomotor nerve involvement, and MRI of brain was normal in all the cases. None of the patients had isolated weakness of extraocular muscles innervated by only the superior or inferior division of the oculomotor nerve.

Among the other risk factors associated with the development of vasculopathic oculomotor nerve palsy, hypertension was seen most frequently (42.8%), followed by hypercholesterolemia (40%), smoking (28.57%), coronary artery disease (14.2%) and alcoholism (11.3%).

9 patients (25.7%) were found to have an internal ophthalmoplegia along with external ophthalmoplegia. The mean age in this group was 57.56 ± 11.98 years (ranging from 40 to 78 years), and mean duration of diabetes was 7.27 ± 5.7 years. Patients presented to us on an average 9.1 ± 6.5 days after the onset of symptoms. Some degree of anisocoria (pathological and simple anisocoria) was measured in 31.1% of the patients at presentation. Based on pupillary findings at the final visit, 4 kinds of patterns could be identified in all subjects.

In 9 patients, the measure of anisocoria ranged from 1 mm to 2 mm (median size 1.5 mm) with the frequency distributed equally between 1, 1.5, and 2 mm of anisocoria (33.3%). None of these patients had a fully-dilated, non-reactive pupil.

Figure 1 represents the course of anisocoria at each visit for each of the 9 patients (A - I) who had pupillary involvement. In patients with incomplete resolution, residual anisocoria was ≤1 mm. The direct pupillary reaction was impaired variably in all subjects during the 1st 2 visits, but the reaction normalized or near normalized as ophthalmoplegia resolved. Patient ‘C’ and ‘E’ were lost to follow-up at 2nd and 3rd visit, respectively.

Comparison of anisocoria at different visits (Post Hoc tests) revealed that there was a significant difference in the degree of anisocoria between the 1st and 3rd visits (P = 0.02) and the 2nd and 3rd visits (P = 0.02). In most of the patients with pupillary involvement, the maximum anisocoria developed within the 1st 2 weeks after the onset of symptoms. Mean time between the onset of symptoms and maximum anisocoria was 9 days.

Figure 2: Time taken to develop maximum anisocoria (the last data point plotted for each patient (A-I) represents the maximum anisocoria recorded). In 62.5% of the patients with pupillary involvement Figure 3, a complete resolution of ophthalmoplegia was seen (A, B, C, D, and F). Comparison of grades of ophthalmoplegia between different visits by the Post Hoc test revealed that there was a significant difference in the ophthalmoplegia grades between the 1st and 2nd visit (P = 0.033), the 2nd and 3rd visit.
Table 1 shows demographic and clinical characteristics of all the 35 patients recruited in the study.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>Gender, No (%) of patients</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>22 (63)</td>
</tr>
<tr>
<td>F</td>
<td>13 (37)</td>
</tr>
<tr>
<td>Mean age in years (range)</td>
<td>60.9 (40-80)</td>
</tr>
<tr>
<td>Mean duration of diabetes in years (range)</td>
<td>7.7 (1-20)</td>
</tr>
<tr>
<td>No (%) of patients with established diabetes</td>
<td></td>
</tr>
<tr>
<td>Type 1</td>
<td>11 (31)</td>
</tr>
<tr>
<td>Type 2</td>
<td>24 (69)</td>
</tr>
<tr>
<td>Mean duration of symptoms in days (range)</td>
<td>8 (2-23)</td>
</tr>
<tr>
<td>Symptoms (%)</td>
<td></td>
</tr>
<tr>
<td>Headache</td>
<td>27 (77)</td>
</tr>
<tr>
<td>Diplopia</td>
<td>22 (62.8)</td>
</tr>
<tr>
<td>Periocular pain</td>
<td>17 (48.5)</td>
</tr>
</tbody>
</table>

Table 2: Pattern and degree of anisocoria

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>24</td>
<td>68.5</td>
</tr>
<tr>
<td>Completely resolved</td>
<td>5</td>
<td>14.29</td>
</tr>
<tr>
<td>Incompletely resolved</td>
<td>3</td>
<td>8.57</td>
</tr>
<tr>
<td>Simple</td>
<td>2</td>
<td>5.71</td>
</tr>
<tr>
<td>Lost to follow-up</td>
<td>1</td>
<td>2.8</td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td>100</td>
</tr>
<tr>
<td>Degree of anisocoria (mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>33.3</td>
</tr>
<tr>
<td>1.5</td>
<td>3</td>
<td>33.3</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>33.3</td>
</tr>
</tbody>
</table>

Table 3: Diabetic retinopathy and internal ophthalmoplegia

| No DR | 6     | 66.6       |
| Mild NPDR | 2     | 22.2       |
| Moderate NPDR | 0   | 0          |
| Severe NPDR | 1    | 11.1       |
| PDR | 0     | 0          |
| Total | 9     | 100        |

DISCUSSION:
The present study was aimed at deriving a reliable estimate of incidence of pupillary involvement in diabetes-associated oculomotor nerve palsy. It was unique in that it was a prospective study unlike many other previous studies and that pupillary measurements were done after minimizing variables, which could influence the size of the pupil. The level of scrutiny was increased by measuring pupil size to the nearest of 0.5mm in all patients. Additionally, the course of anisocoria was compared with that of ophthalmoplegia. Analysis of data shows that the incidence of pupillary involvement was 25.7%. In a similar study by Jacobson,
the incidence was found to be 22.7%.11 But, the difference in the incidences, found on comparing our study with that of Jacobson, was statistically not significant on doing chi square test \((P = 0.288)\). Most previous studies quote much lower incidences than that derived from this study and the study by Jacobson,13,6,7

The reason for this could be two fold. Most previous studies chose pupillary reaction to light as the primary end point for defining pupil involvement. This could have led to underestimation of the pupil involvement as reaction of pupil to light could be influenced by various factors, like brightness of light, emotional stimuli and accommodation. In this study, the primary end point was anisocoria rather than pupillary reaction to light. As all other external factors which could influence the pupillary size were controlled, the difference in size of the involved pupil and the fellow pupil was more accurate in predicting pupil involvement than pupillary reaction alone.

Secondly, in our study, the level of accuracy of pupillary measurement was increased by using a pupil gauge with a unit measurement of 0.5 mm. Most patients developed maximum anisocoria within the 1st 2 weeks after onset of symptoms, which is also similar to the observation in Jacobson’s study.11 However, this time interval could have been artificially prolonged as patients were not followed up on a daily basis. Had all patients been seen on a daily basis, the maximum anisocoria might have been detected at a much earlier stage.

A fully-dilated, non-reactive pupil is found in 51% to 71% of patients with aneurysmal compression of oculomotor nerve.3,12 In aneurysms compressing the 3rd nerve, anisocoria progresses and the pupil becomes maximally dilated within the 1st 2 weeks of the presentation. A certain number of patients in this study too showed progression of anisocoria during the 1st 2 weeks of presentation. But, the pupil remained incompletely involved and variably reactive in all patients in this study. Additionally, none of the patients had an anisocoria of > 2 mm. These characteristics of the pupil help to distinguish diabetic from aneurysmal injury of the oculomotor nerve. From the statistical analysis performed on the course of anisocoria, it can be inferred that the degree of anisocoria normalized maximally by the 3rd visit (after 8 weeks) as compared to the 2nd visit (after 2 weeks). While 1 patient was lost to follow-up, pupil normalized in a majority of patients (55.5%). The direct pupillary reaction, which was impaired during the initial 2 visits, normalized or near normalized as the ophthalmoplegia reversed and the pupil came back to its original size.

Majority of subjects in both pupil-involved and pupil-spared groups showed a recovery of ophthalmoplegia over the initial 2 visits. This is in contrast to a study by Jacobson and Broste where an early progression of ophthalmoplegia was seen in 69% of the individuals and mentions that early progression may not be recognized as a common characteristic if the patient is first seen after 1 week of onset of double vision.9 The reason for discrepancy between the findings of this study and that of the above-stated study might be due to the fact that majority of subjects in our study presented to us after 1 week of onset of their symptoms and also that the subjects were followed up 2 weeks after their initial visit. Ophthalmoplegia would have already-progressed and then recovered by the time we identified a change from the previous visit to a subsequent evaluation. Had all patients been seen on a daily basis, the progression would have been probably more evident. It was also inferred that ophthalmoplegia recovers relatively more significantly and much earlier than anisocoria.

No statistically significant difference was found between the course of anisocoria and ophthalmoplegia although clinically both anisocoria and ophthalmoplegia showed an improvement and resolution at the 3rd visit in majority of the subjects. Although the \(P\) value was not significant \((P \text{ value 0.086})\), it was close to 0.05, which denotes that a statistically significant association would have been seen had the sample size been more in the present series.

Majority of the patients with pupillary involvement showed no diabetic retinopathy changes or had less severe grades of diabetic retinopathy. A Similar result was reported in a study by Acaroglu et al., in which presence and level of diabetic retinopathy was found to be significantly lower in diabetics with cranial nerve palsies than in the age, sex, and diseaseduration-matched controls.13 The relatively milder form of diabetic retinopathy could be accounted for by the shorter duration of diabetes in the majority of subjects (Mean 7.27 years).

CONCLUSION:
Pupil involvement in patients with diabetes-associated oculomotor nerve palsy occurs in about 1/4th of all cases. Although pupil may be involved in both, certain pupil characteristics like an incomplete involvement and anisocoria < 2 mm may help to distinguish diabetic (ischemic) from aneurysmal (compressive) injury of the oculomotor nerve. Imaging may not be required in pupil-sparing oculomotor nerve palsies in patients over 50 years with known vasculopathic risk factors although this is associated with the rare risk of missing an aneurysm sparing the pupils. These patients could be just treated conservatively and followed up on a regular basis, if possible almost daily for 2 weeks for progression of
anisocoria and ophthalmoplegia to diagnose an early
aneurysm as mortality rate due to aneurysm rupture
could reach up to 86% and 20% of untreated aneurysms
will re-bleed within 2 weeks of the 1st bleed.14,15

Imaging should be considered in those cases of
pupil-involved oculomotor nerve palsies if patient
presents with additional cranial nerve palsy or
neurological abnormalities and pupil shows
characteristics of a compressive lesion even if history is
suggestive of an ischemic lesion. Majority of cases of
ischemic oculomotor nerve palsy show spontaneous
resolution with medical treatment alone in contrast to
nerve palsy due to aneurysmal injury where earliest
possible surgical intervention is required.

Limitations of this study include the following
issues. The incidence could have been more accurate
had the sample size been more than that in the current
study. The course of ophthalmoplegia and anisocoria
could have been more precisely-studied had the
patients been followed up at closer intervals or even on
a daily basis.

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Vertical Strabismus after Conjunctival Scarring Masquerading as Superior Oblique Palsy

Saemah Nuzhat Zafar, FCPS, FRCS¹ Sorath Noorani Siddiqui, FCPS²

ABSTRACT:
A patient, who presented with diplopia after a history of dog bite to the supero-medial part of the eye, had conjunctival scarring over the medial rectus insertion and symblepharon. He had limitation of depression in adduction, simulating superior oblique palsy. Unreliability of a three step test in vertical strabismus when there are scars is highlighted.

Key Words: superior oblique palsy; canine tooth syndrome; vertical strabismus; diplopia.

INTRODUCTION:
Superior oblique muscle is affected frequently in acquired extraocular muscle palsy. Strengthening the muscle requires caution, to avoid iatrogenic side effects of restricted elevation in adduction.¹ The choice of the correct surgical procedure depends on the results of the traction testing of the superior oblique tendon preoperatively.

The typical ‘canine tooth syndrome’ was classified as type 7 superior oblique palsy by Knapp in which there is weakness of the superior oblique muscle evident by the failure of depression in adduction along with inability to elevate the eye in adduction.² The management of such a case is presented where some clinical features resembled the canine tooth syndrome.

CASE REPORT:
A 52 year old patient presented to the pediatric and strabismus unit of our tertiary care eye hospital with complaints of diplopia on down gaze. He had a history of repair for the extensive trauma to the right upper lid and brow area, after a dog bite to the supero-medial part of the right eye, 2 years ago. The patient’s systemic examination and laboratory reports of blood glucose and complete blood count were within normal limits. On ocular examination he had a slight head tilt towards the left. His visual acuity was 6/6 with normal fundus and normal foveal position in both eyes (OU). He had an exotropia (XT) of 10 prism diopters (PD) with right hypertropia of 18 PD and 12 PD XT with left hypotropia of 20 PD, on prism cover test. The orthoptist’s notes stated that right hypertropia increased to 30 PD on left gaze and on right head tilt to 25 PD. He had a limitation of depression in adduction of -3.5 (Figure 1), on a scale of -1 to -4, indicating -1 as minimum limitation of depression and -4 as no depression. He also had a slight over action of right inferior oblique, measuring +0.75, on a scale of 0 to 4. On up-gaze, exotropia increased to 16 PD while on down gaze it remained 10 PD. Right hypertropia on down gaze was 30 PD and left hypotropia on down gaze measured 30 PD. Diplopia was present in down-gaze and on dextro and laevo-depression. Hess test showed under action of the right superior oblique and the right medial rectus.

In the operating room, scar mark over the brow, lid margin defect, symblepharon and conjunctival scarring were noted, more so at the site of insertion of the medial rectus (Figure 2). Positive forced duction test (FDT) was +2 for the right medial rectus on attempted abduction, and negative for all other muscles. Normal ‘bump’ of the right superior oblique tendon was felt and did not reveal any laxity. FDT was negative for all extra ocular muscles in the left eye.

The lid notch was repaired along with releasing the symblepharon. Pedicle conjunctival graft was sutured over the bare sclera resulting from released bands of conjunctival fibrosis. An adjustable suture recession of the yoke inferior rectus of the contra lateral eye was performed. Minimal diplopia was appreciable on the first post operative day with correction of left hypotropia. Patient became symptom free on follow up.

DISCUSSION:
Our patient differed from the typical presentation described in canine tooth syndrome³ or the dog bite syndrome,⁴ in that, the paradoxical limitation of elevation in adduction was not evident enough and there was no superior oblique palsy, as became evident on forced duction test. Parks three step test which is
useful in identifying a single under acting muscle in vertical and tortional deviations, proved deceptive in our patient having restrictive etiology. Forced duction test in the operating room however helped in making the surgical decision by ruling out the superior oblique weakness.

Spontaneous recovery may occur in canine tooth syndrome, during the first 4 to 6 months when management is by conservative observation. Two years had already passed after the initial injury and surgical intervention was planned when the patient presented to us with a stable angle of deviation. There was conjunctival fibrosis at the insertion of the medial rectus but the muscle was found intact in our patient. Such a bite however can result in muscle being severed. The present case highlights a restrictive etiology of features after dog bite injury, without the commonly described superior oblique muscle palsy in such a scenario. This case demonstrates how unreliable the three step head tilt test is in cases of orbital scars particularly when involving cyclovertical muscles. Ophthalmologists should be conscious of such faulty use of this test leading to erroneous diagnosis of a superior oblique ‘palsy’ when in fact, scarring of the anterior orbital tissues caused a restrictive motility deficit cured by the removal of the scar. The limitation in our report is that we however did a simultaneous adjustable suture recession of the inferior rectus of the contra-lateral eye (the yoke muscle of the superior oblique). Our report would have been better authenticated if a two stage surgery with initial release of symblepharon was carried out to establish conjunctival fibrosis as a cause of vertical strabismus. The patient coming from far with monetary constraints was one factor to correct the hypotropia in a single surgery using the adjustable suture technique. This was done as a safety measure, in case the removal of the long standing conjunctival fibrosis was not adequate enough to correct the vertical strabismus. Our patient had all the classical features of a right superior oblique palsy (slight head tilt towards the left, a right hypertropia which increased in left gaze and on right head tilt, a significant limitation of depression in adduction, a slight overaction of the right inferior oblique, and an underaction of the right superior oblique on Hess test. The authors considered the fact that a normal superior oblique tendon on FDT is present in acquired palsies was. However, it was the release of the fibrotic conjunctival scars that lead to improvement of the restrictive strabismus post operatively.

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Anti-Angiogenics in Vaso-Occlusive Disorder of Retinal Vein

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Republic of Armenia

ABSTRACT

Background: Vascular Endothelial Growth Factor (VEGF) appears to be essential for development and maintenance of functionally efficient retinal vasculature as well as for integrity of the retinal pigment epithelium, Bruch’s membrane and choroidal endothelial cells. Tissue hypoxia due to primary vascular occlusive disease is the most common driver of VEGF synthesis and as retinal vein occlusion is associated with increased levels of VEGF, therapy by anti-angiogenics or vascular endothelial growth factor inhibitors (anti-VEGF) was proposed to be a promising strategy for retinal vein occlusion. Consequently, several anti-angiogenics have been developed for the treatment of vaso-occlusive disease of retinal vein, and ophthalmology has witnessed an explosion in the number of intravitreal injections delivered to patients over the past 10 years, driven in large part by the introduction and rapid incorporation of therapy with anti-VEGF agents.

The objective of this review is to evaluate the efficacy of pharmacotherapy by VEGF inhibitors in vaso-occlusive disorder of retinal vein, in the light of our current scientific knowledge about this disorder.

Key words: vascular endothelial growth factor, vascular endothelial growth factor inhibitors, pharmacotherapy, retinal vein occlusion.

INTRODUCTION

The role of VEGF in the growth of both regular and abnormal blood vessels was identified in the 1980s, and agents that could block the angiogenic cascade first came on the scene for cancer treatments in the early 1990s. Monoclonal antibodies against VEGF were first developed as an intravenous treatment for metastatic colorectal cancer1,2.

The increase in VEGF, a cytokine, is triggered by hypoxia in pathological conditions. Human eyes with central retinal vein occlusion (CRVO) showed evidence of intra-retinal upregulated expression of VEGF mRNA3. Indeed, raised levels of VEGF have been reported in both the aqueous and vitreous fluid of patients with ischemic CRVO, and are responsible for the increase in vascular permeability that leads to macular edema (ME)4. Aqueous and vitreous levels of VEGF were significantly correlated with the severity of ME5,6. The development of therapy with anti-angiogenics or vascular endothelial growth factor inhibitors (anti-VEGF) has marked the beginning of a new era in eye diseases treatment. After 2 decades of extensive research into the VEGF families and receptors, specific molecules have been targeted for drug development, and several medications have received US-FDA approval.

The objective of this review is to evaluate the efficacy of pharmacotherapy by anti-VEGF in vaso-occlusive disorder of retinal vein, in the light of our current scientific knowledge about this disorder.

VEGF in the Eye: Physiology and Pathophysiology:

VEGF is produced by retinal pigment epithelial cells, neurons, glial cells, endothelial cells, ganglion cells, Muller cells, and smooth muscle cells. VEGF appears to be essential for development and maintenance of functionally efficient retinal vasculature as well as for integrity of the retinal pigment epithelium (RPE), Bruch’s membrane and choroidal endothelial cells7. Although VEGF affects all cells within the retina, its primary targets are vascular endothelial cells. VEGF plays an important role in the patho-physiology of retinal vein occlusion and contributes to increased permeability across both the blood-retinal and blood-brain barriers.

In central retinal vein occlusion (CRVO) there is increased intraluminal and interstitial pressure throughout the retina drained by the obstructed vessels, resulting in reduced arterial perfusion, which is exacerbated by pre-existent arterial insufficiency, and in variable amounts of retinal ischemia. Retinal ischemia causes increased production of vascular endothelial growth factor (VEGF), which causes vascular leakage and macular edema. High levels of VEGF also promote retinal hemorrhages and exacerbate capillary nonperfusion8. Raised levels of VEGF have been reported in both the aqueous and vitreous fluid of
patients with ischemic CRVO, and are responsible for the increase in vascular permeability that leads to ME\textsuperscript{4}.

Branch retinal vein occlusion (BRVO) also leads to retinal ischemia that induces the production of cytokines such as VEGF by retinal cells such as glial cells and vascular endothelial cells in the occluded region affected by anoxia. These cytokines interact with each other (cytokine network) and this results in impairment of the blood-retinal barrier and an increase of vascular permeability, considered important in the development of macular edema associated with BRVO\textsuperscript{9}.

**ANTI-ANGIOGENICS IN RETINAL VEIN OCCLUSION THERAPY:**

The term anti-angiogenic therapy was born more than 35 years ago by J. Folkman, who hypothesized that cancer may be treated by abolishing the nutrients and oxygen-providing blood vessels and bevacizumab became the first therapy approved by the US - FDA designed to inhibit angiogenesis in tumors. As retinal vein occlusion is associated with increased levels of VEGF, anti-VEGF therapy was proposed to be a promising strategy for retinal vein occlusion.

Intraocular injections of a VEGF-binding protein reduce vascular leakage, resulting in improvement in macular edema, accelerate resorption of retinal hemorrhages, and prevent worsening of capillary nonperfusion\textsuperscript{8,10}. There are 4 anti-VEGF agents that are either approved or in common use in ophthalmology, namely ranibizumab (Lucentis-Novartis), bevacizumab (Avastin-Roche), pegaptanib (Macugen-Pfizer), and aflibercept or VEGF Trap-Eye (EYLEA- Bayer).

**Lucentis.**

In June 2006, Lucentis (ranibizumab, Roche/Genentech) has first received FDA approval for the treatment of macular edema due to both CRVO and BRVO.

Ranibizumab is a humanized, affinity-matured VEGF antibody fragment that binds to and neutralizes all isoforms of VEGF. Two phase III multicenter, prospective clinical trials assessing the safety, tolerability and efficacy of intravitreal ranibizumab injections in the treatment of macular edema secondary to BRVO and CRVO\textsuperscript{10} were finished. They are called BRAVO (study of the efficacy and safety of ranibizumab injection compared with sham in patients with macular edema due to BRVO)\textsuperscript{11} and CRUISE (study of the efficacy and safety of ranibizumab injection compared with sham in patients with macular edema due to CRVO)\textsuperscript{12}.

In the BRAVO study\textsuperscript{11} 397 patients with macular edema following branch retinal vein occlusion (BRVO) were randomized to receive monthly intraocular injections of 0.3 mg (n = 134) or 0.5 mg (n = 131) of ranibizumab or sham injections (n = 132). Patients were eligible if they had foveal-involved macular edema from a BRVO occurring within 12 months of study. Starting at month 3, patients were eligible for grid laser treatment if hemorrhages had cleared sufficiently to allow safe application of laser.

Based upon the NEI VFQ-25 survey, patients who received ranibizumab felt they had greater improvement. There was greater reduction of macular edema in the ranibizumab groups because CPT was reduced by 433.7 μm (0.3 mg) and 452.3 μm (0.5 mg) compared to 157.7 μm in the sham group. In the CRUISE Study\textsuperscript{12}, 392 patients with macular edema following central retinal vein occlusion (CRVO) were randomized to receive monthly intravitreal injections of 0.3 mg (n = 132) or 0.5 mg (n = 130) of ranibizumab or sham injections (n = 130). Patients were eligible if they had foveal-involved macular edema from a CRVO occurring within 12 months of study. Patients were excluded if they had a brisk afferent pupil defect, had scatter laser photocoagulation within 3 months, an intraretinal injection of steroid or a VEGF antagonist within 3 months, or had an improvement of ≥10 ETDRS letters in BCVA between screening and baseline.

Baseline characteristics were well balanced among the three groups; the mean age was 68 years, mean BCVA was 20/100, the mean time from diagnosis of CRVO was 3.3 months, and the mean center point thickness (CPT) was 685 μm. Based upon the 25-item National Eye Institute Visual Function Questionnaire NEI VFQ-25 survey, patients who received ranibizumab felt they had greater improvement (improvement from baseline in NEI VFQ score: 7.1, 0.3 mg; 6.2, 0.5 mg; 2.8, sham)\textsuperscript{12}. There was greater reduction of macular edema in the ranibizumab groups because CPT was reduced by 433.7 μm (0.3 mg) and 452.3 μm (0.5 mg) compared to 167.7 μm in the sham group. This study demonstrated that six sessions of monthly injections of 0.3 mg or 0.5 mg reduced macular edema and provided substantial visual benefit in patients with CRVO.

After the primary endpoint in the CRUISE and BRAVO trials, patients were evaluated every month and if study eye Snellen equivalent BCVA was ≤20/40 or mean CST was ≥250 μm, they received an injection of ranibizumab; patients in the ranibizumab groups received their assigned dose and patients in the sham group received 0.5 mg. In patients with CRVO, the mean number of ranibizumab injections during the observation period was 3.9, 3.6, and 4.2 in the 0.3 mg, 0.5 mg, and sham/0.5 mg groups; and the percentage of patients that did not receive any injections during the observation period was 7.0, 6.7, and 4.3, respectively\textsuperscript{14}. At month 12 in the ranibizumab groups, the improvement from baseline in ETDRS letter score was 13.9, very similar to the month 6 results, indicating
that vision is well maintained when injections are given only if there is recurrent or residual macular edema. Patients in the sham group showed substantial improvement during the observation period when they were able to receive ranibizumab; improvement from baseline in letter score was 0.8 at month 6 and 7.3 at month 12. The percentage of patients who had an improvement from baseline BCVA letter score ≥15 at month 12 was 47.0% (0.3 mg) and 50.8% (0.5 mg) in the ranibizumab groups, almost identical to the month 6 results. In the sham group, 33.1% of patients improved from baseline ≥15 in letter score at month 12 compared to 16.9% at month 6. At month 12, 43% of patients in the two ranibizumab groups had a Snellen equivalent BCVA of 20/40 compared to 35% in the sham/0.5 mg group.

In patients with BRVO, the mean number of ranibizumab injections during the observation period was 2.9, 2.8, and 3.8 in the 0.3 mg, 0.5 mg, and sham/0.5 mg groups; and the percentage of patients that did not receive any injections during the observation period was 17.2, 20.0, and 6.5, respectively. At month 12 in the ranibizumab groups, the improvement from baseline in ETDRS letter score was 16.4 (0.3 mg) and 18.3 (0.5 mg), very similar to the month 6 results, indicating that vision is well maintained when injections are given only if there is recurrent or residual macular edema. Patients in the sham group showed substantial improvement during the observation period when they were able to receive ranibizumab; improvement from baseline in letter score was 7.3 at month 6 and 12.1 at month 12. The percentage of patients who had an improvement from baseline BCVA letter score ≥15 at month 12 was 55.2% (0.3 mg) and 61.1% (0.5 mg) in the ranibizumab groups, almost identical to the month 6 results. In the sham group, 43.9% of patients improved from baseline ≥15 in letter score at month 12 compared to 28.8% at month 6. At month 12, 67.9% (0.3 mg) and 64.4% (0.5 mg) of patients in the ranibizumab groups had a Snellen equivalent BCVA of 20/40 compared to 56.8% in the sham/0.5 mg group. Thus, in both CRUISE and BRAVO, patients in the sham groups showed a substantial improvement in vision during the second 6 months when they were able to receive ranibizumab as needed, but their vision at month 12 was not as good as that in patients in the ranibizumab groups. This raises a question as to whether delay in treatment carries a visual penalty.

The results from open-label extension trial of the 12-month Ranibizumab assessing long-term safety and efficacy in BRAVO and CRUISE trials evidenced that in patients who completed month 12, the mean number of injections (excluding month 12 injection) in the sham/0.5-, 0.3/0.5-, and 0.5-mg groups was 2.0, 2.4, and 2.1 (branch RVO) and 2.9, 3.8, and 3.5 (central RVO), respectively. The incidence of study eye ocular serious adverse events and systemic adverse events potentially related to systemic VEGF inhibition across treatment arms was 2% to 9% and 1% to 6%, respectively. The mean change from baseline BCVA letter score at month 12 in branch RVO patients was 0.9 (sham/0.5 mg), -2.3 (0.3/0.5 mg), and -0.7 (0.5 mg), respectively. The authors concluded that no new safety events were identified with long-term use of ranibizumab; rates of systemic adverse events potentially related to treatment were consistent with prior ranibizumab trials. Reduced follow-up and fewer ranibizumab injections in the second year of treatment were associated with a decline in vision in central RVO patients, but vision in branch RVO patients remained stable. Results suggest that during the second year of ranibizumab treatment of RVO patients, follow-up and injections should be individualized and, on average, central RVO patients may require more frequent follow-up than every 3 months.

In addition, the sub-analyses in BRAVO and CRUISE study generally confirmed that patients with BRVO or CRVO who were younger or who had worse vision and greater retinal thickness at baseline fared better. Patients with BRVO fared better if time from diagnosis to treatment was less than 3 months. Patients with CRVO had similar results regardless of time to treatment.

In general, then, in BRVO, patients who needed fewer therapies, such as laser or other previous treatments, probably had milder RVO requiring less treatment. Patients who were younger did better than those who were older, and patients with CRVO had a more unpredictable course than those with BRVO, and therefore warrant even closer observation than those with BRVO.

Avastin:

Avastin(bevacizumab (Avastin), is FDA-approved for the treatment of colorectal cancer. However, because the agent costs substantially less per dose than Lucentis, it has been widely used off-label since 2004 to treat several retinal diseases, including retinal vein occlusion. Bevacizumab is a recombinant humanized monoclonal antibody directed against VEGF. Recently, Ghayoor et al. evaluated the effect of Avastin (mean 2.8 injections) in 8 eyes with CRVO- and 22 with BRVO-associated macular edema and claimed that significant improvement in best corrected VA was observed at 6th week of follow-up. At 6th month more than 60% showed improvement in best corrected visual acuity, similarly 70% patients had complete resolution of macular edema. The authors concluded that anti-VEGF therapy should be further evaluated in large,
prospective, controlled clinical studies.

At the latest prospective study Dallen et al. evaluating the 12-month outcome and predictive factors of visual acuity (VA) changes following bevacizumab therapy for CRVO concluded that early injections of bevacizumab in young patients in whom VA is relatively preserved leads to a significant improvement in VA. Ischaemic CRVO and poor baseline VA are associated with non-response to such therapy.

Epstein et al. conducted the latest prospective double-masked clinical trial of 60 patients with macular edema secondary to CRVO randomized 1:1 to receive intraocular injections of bevacizumab or sham injection every 6 weeks for 6 months. Results evidenced that the treatment improve VA and reduce macular edema significantly compared with sham. The International Intravitreal Bevacizumab Safety Survey gathered adverse events from doctors around the world via the internet and showed all ocular and systemic side effects to be under 0.21% including corneal abrasion, lens injury, endophthalmitis, retinal detachment, inflammation or uveitis, cataract progression, acute vision loss, central retinal artery occlusion, sub-retinal haemorrhage, retinal pigment epithelium tears, blood pressure elevation, transient ischaemic attack, cerebrovascular accident and death. Fung. et al. concluded that self-reporting of adverse events after intravitreal bevacizumab injections did not show an increased rate of potential drug-related ocular or systemic events and these short-term results suggest that intravitreal bevacizumab seems to be safe.

Macugen:

In 2004, Macugen (pegaptanib sodium-Pfizer and OSI/Eyetech Pharmaceuticals, Inc.) was the first anti-VEGF agent to receive FDA approval for the treatment of neovascular age-related macular degeneration (AMD). Macugen is a selective anti-VEGF compound that is designed to inhibit one strain of VEGF. It should be administered via intravitreal injection every six weeks. Although the use of Macugen has declined with the release of newer anti-VEGF agents, such as Lucentis and Avastin, it appears to be making a comeback because of its more favorable dosing frequency (e.g., every six weeks vs. every four weeks). Additionally, Macugen is associated with a lower risk of stroke than either Lucentis or Avastin. The pegaptanib sodium is still not well studied in RVO. Bennet performed a pilot study where Macugen treatment achieved a decrease in macular thickness and an improvement in VA and retinal perfusion. But this study had enrolled only 7 patients with 6 months of follow-up and it had no control group. On the other hand, Wroblewski et al. conducted a study where subjects with BRVO were randomized 3:1 to intravitreal injections of pegaptanib 0.3 or 1 mg at baseline and at weeks 6 and 12 with subsequent injections at 6-week intervals at the discretion of the investigator until week 48. He also found improvements in VA and macular thickness in this study with a 54-week follow-up. Therefore, the authors consider that intravitreal pegaptanib offers a promising alternative for macular edema secondary to BRVO.

VEGF Trap:

The VEGF trap is another novel anti-VEGF agent aflibercept (Eyeyea, Regeneron). It is essentially a small, fully human, soluble VEGF receptor that acts as a decoy receptor binding-free VEGF. Aflibercept was approved for macular edema following CRVO in September 2012. The VEGF trap eye is currently under evaluation in two phase III studies on CRVO (GALILEO and COPERNICUS Studies) with 6-monthly injections of drug or sham-controlled injections. The latest six-months results of the Phase 3 from COPERNICUS Study multicenter, randomized, prospective, controlled trial assessing the efficacy and safety of intravitreal Trap-Eye in 189 eyes with macular edema secondary to central retinal vein occlusion (CRVO) randomized 3:2 to receive VEGF Trap-Eye 2 mg or sham injection monthly for 6 months evidenced that at week 24, 56.1% of VEGF Trap-Eye treated eyes gained 15 letters or more from baseline versus 12.3% of sham-treated eyes (P = 0.001). The VEGF Trap-Eye treated eyes gained a mean of 17.3 letters versus sham-treated eyes, which lost 4.0 letters (P < 0.001). Central retinal thickness decreased by 457.2 mm in eyes treated with VEGF Trap-Eye versus 144.8 mm in sham-treated eyes (P < 0.001), and progression to any neovascularization occurred in 0 and 5 (6.8%) of eyes treated with VEGF Trap-Eye and sham-treated eyes, respectively (P = 0.006). Conjunctival hemorrhage, reduced visual acuity, and eye pain were the most common adverse events. Serious adverse effects ocular were reported by 3.5% of VEGF Trap-Eye patients and 13.5% of sham patients. Incidences of nonocular serious adverse events generally were well balanced between both groups. The authors concluded that at 24 weeks, monthly intravitreal injection of VEGF Trap-Eye 2 mg in eyes with macular edema resulting from CRVO improved visual acuity and central retinal thickness, eliminated progression resulting from neovascularization, and was associated with a low rate of ocular adverse events related to treatment. Dr. Korobe Inik presented the results on behalf of the GALILEO investigators at the annual meeting of the American Academy of Ophthalmology GALILEO is a double-masked study conducted at 62 centers in Europe and Asia. It randomly assigned 177 patients 3:2 to receive intravitreal aflibercept 2 mg or sham every 4 weeks until week 24. Between week 24 and 52, patients...
continued monthly monitoring, but the aflibercept eyes received treatment as needed while the sham group continued to receive sham treatment every 4 weeks. From weeks 52 to 76, the inter-visit interval was extended to 8 weeks and sham patients were eligible for aflibercept. Nearly three-fourths of sham eyes and 85% of the aflibercept eyes completed 76 weeks of follow-up. During the first 24 weeks of GALILEO, monthly aflibercept treatment resulted in rapid and sustained gains in best-corrected visual acuity. The improvement was largely maintained through week 52, but declined some between weeks 52 and 76. Similar temporal patterns were seen in analyses of changes in central retinal thickness (CRT) and proportion of eyes without retinal fluid in the aflibercept treatment group.

After becoming eligible for aflibercept, eyes in the sham group gained vision and had decreased CRT. However, outcomes at week 76 were superior in the eyes that had been treated with aflibercept since entry. Results from follow-up to 76 weeks in the phase III GALILEO study show that intravitreal injection of aflibercept (Eylea, Regeneron Pharmaceuticals) provides marked improvement in visual acuity in treatment-naive eyes with macular edema secondary to central retinal vein occlusion. However, the data also suggest the value of close monitoring and early treatment. The results of GALILEO and COPERNICUS are encouraging for patients with central retinal vein occlusion.

Potential Hazards of Anti-VEGF Therapy:

Local adverse effects: Intravitreal injections of various agents have been studied extensively. The overall risk of complications are low when the injection is administered by experienced ophthalmologists. Known risks of intravitreal injections can be vision threatening and require prompt diagnosis and treatment, possibly surgical intervention. The most serious but rarely occurring injection-related complications include acute-onset endophthalmitis, pseudo-endophthalmitis, cataract development/progression, retinal detachment, and hemorrhage. Additional infrequent complications include hypotony, angle closure, hemi-retinal vein occlusion, retinal pigment epithelial tears, iritis/uveitis, optic disc atrophy, corneal epitheliopathy, maculopathy central retinal artery occlusion. The latest study showed that endophthalmitis following intravitreal injection is associated with an increased incidence of Streptococcus spp. infection, earlier presentation and poorer visual outcomes when compared with endophthalmitis following cataract surgery. Irigoyen et al. concluded that the overall numbers of patients with endophthalmitis following intravitreal injections has risen dramatically over the past years. In contrast to earlier reports of multicentre studies, outcome of patients is relatively poor in the current treatment settings.

The preparation of the intravitreal injection site with topical povidone-iodine is the preferred prophylactic method to minimize the risk of endophthalmitis. There is no need for topical antibiotic use after intravitreal injection. Additional infrequent complication include anaphylactic reaction to the agent injected in the vitreous. A 2006 national survey in USA Complications reported following complications rate associated with intravitreal injections: endophthalmitis - 31%, increased IOP - 26%, cataract - 11%, other - 16%. The most important adverse local effects related to anti-VEGF agents include uveitis, retinal detachment and cataracts.

The latest study on the rate of serious adverse effects in a series of bevacizumab and ranibizumab injections revealed that subjects who received bevacizumab were 12 times more likely to develop severe intraocular inflammation following each injection than were those who received ranibizumab. One of acute intraocular inflammation following ranibizumab injection was mild and not associated with vision loss. No other serious ocular complications were noted. A trend was also noted toward an increased risk for arterial thromboembolic events in patients receiving bevacizumab, although the confidence interval was wide. In conclusion, authors stated that significant concern still exists regarding the safety of off-label use of intravitreal bevacizumab. Patients receiving bevacizumab should be counseled regarding a possible increased risk for serious adverse events. Anti-VEGF therapy may therefore have adverse effects on ocular blood flow. Von Hanno et al. presented two cases of retinal artery occlusion after intravitreal injection of bevacizumab (Avastin) and ranibizumab (Lucentis) respectively and concluded that the therapeutic principle may be associated with an increased risk of retinal arterial occlusions.

Leung et al. presented a series of three patients of the nearly 200 patients with CRVO who suffered apparent macular infarction within weeks of intravitreal administration of bevacizumab. The authors stated that this has not been described in the natural history of the disease and is associated with poor visual outcomes. In Manousaridis and Talks opinion worsening of macular ischaemia in the long term cannot be definitely excluded, particularly in eyes with significant ischaemia at baseline and after repeated intraocular anti-VEGF injections. The decision to offer prolonged anti-VEGF treatment in cases of significant coexisting macular ischaemia should not be based only on measurements of macular thickness; instead repeat fluorescein
angiograms should be performed. In conclusion, the overall risk of complications is low when the injection is administered by experienced ophthalmologists.

**Tachyphylaxis/tolerance:**

The worldwide use of intravitreal application of anti-vascular growth factor and the realisation that regular applications over long periods of time are necessary to maintain vision in these eyes, has revealed the problem of tolerance/tachyphylaxis. Binder et al. recommended different options to prevent tachyphylaxis/tolerance: (1) to increase the dosage or shorten treatment intervals if tolerance has developed; (2) to pause treatment if tachyphylaxis has occurred; (3) to combine drugs with different modes of action; or (4) to switch to a similar drug with different properties (bevacizumab and ranibizumab differ in molecular size, affinity and absorption).

**Systemic adverse effects:**

While used intravitreally, the systemic absorption is minimal, however, a trend has been observed towards a higher risk of stroke among patients with a history of heart disease. Campbell et al. assessing the risk of systemic adverse events associated with intravitreal injections of VEGF inhibiting drugs in the nested case-control study have found that intravitreal injections of bevacizumab and ranibizumab were not associated with significant risks of ischaemic stroke, acute myocardial infarction, congestive heart failure, or venous thromboembolism. Clinical evaluation of ranibizumab (Lucentis) based on two double-blind randomised trials comparing ranibizumab (0.3 mg or 0.5 mg) versus placebo in a total of 795 patients revealed that the incidence of heart failure and transient ischaemic attacks was higher during the second year of ranibizumab therapy than during the first year of treatment. Patients should be informed of the potential adverse effects and uncertainties and be reminded that this condition improves spontaneously in about 50% of cases or almost in one quarter of affected eyes at 3 years. Further controlled and prospective studies are necessary to compare treatment by Lucentis to the natural course with a longer follow-up. There is some evidence that intravitreal anti-VEGF injections may result in systemic absorption, with the potential for injury in organs that are reliant on VEGF, such as the kidney. Pellé et al. reported the first case of a patient who developed an acute decrease in kidney function, non-immune micro-angiopathic hemolytic anemia with schistocytes, and thrombocytopenia after 4 intravitreal injections of ranibizumab. Light microscopy of a kidney biopsy specimen showed segmental duplications of glomerular basement membranes with endothelial swelling and several recanalized arteriolar thrombi. Because of the increasing use of intravitreal anti-VEGF agents, ophthalmologists and nephrologists should be aware of the associated risk of kidney disease. Early detection is crucial so that intravitreal injections can be stopped before severe kidney disease occurs. In Sorenson and Sheibani opinion perhaps baseline and renal function during treatment (serum creatinine and urinary protein levels, blood pressure) should be carefully monitored to ensure that the improved visual acuity is not at the expense of renal function.

**Concerns with anti-VEGF therapy:**

Major concerns with anti-VEGF therapy for ocular diseases include: repeat intravitreal injections; risk of cardiovascular complications; possible retinal and neural toxicity due to cumulative dosing; interference with physiologic functions of VEGF; and economic and cost-effectiveness concerns. Tailoring treatment to the individual patient should increase the chance of treatment success, while sparing patients from unnecessary drug exposure and risk of adverse events. Furthermore, avoiding unnecessary treatment also has the potential to improve the cost-effectiveness of treatment.

Lang also stated that it is important to make decisions about the best treatment in retinal vein occlusion, which necessitates knowledge of the posology of the drug and assessment of the advantages and risks of the different treatment modalities. Therefore it is important to know the efficacy and safety data of the therapy. In conclusion, patients should discuss the potential risks and benefits of intravitreal pharma-cotherapy with their physicians before receiving treatment.

**CONCLUSION**

Vascular endothelial growth factor, a key regulator of angiogenesis and vascular permeability has been implicated in the pathogenesis of retinal diseases associated with neo-vascularisation and edema. As retinal vein occlusion is associated with increased levels of VEGF, anti-VEGF therapy was proposed to be a promising strategy for retinal vein occlusion. Consequently, several anti-angiogenics have been developed for the treatment of vaso-occlusive disease of retinal vein. Treatment regimens have evolved through experience gained in clinical trials and clinical practice. The current treatment regimen for RVO should reflect an individualized treatment approach designed to treat patients when they could benefit the most while minimizing the number of unnecessary intravitreal injections, and hence the risk of adverse events.

Selection of appropriate therapeutic procedure based on the evidence-based medicine, to protect and improve visual function of patients with retinal vein occlusion are the important project of clinicians and require further exploration and investigation.
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Mydriasis in the Garden

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Gabriel Alcoba, M.d.
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Geneva, Switzerland

A healthy 3-year old boy was brought to our emergency department because of an acutely dilated right pupil, which developed after he had played in the garden. Half an hour before presentation his parents noticed he had been crying. They reported no fall and no ocular or head trauma. The right eye showed no pupillary light reflex and no accommodation. Physical examination was otherwise normal. A detailed history revealed that he had touched and held a flower from an angel’s trumpet plant and then rubbed his right eye. Angel’s trumpet, a member of the genus brugmansia, is an ornamental plant from South America that is increasingly found worldwide and contains para-sympatholytic alkaloids such as scopolamine, hyoscyamine, and atropine. In cases of sudden, unilateral, non-reactive mydriasis in healthy children, exposure to angel’s trumpet should be suspected. Severe intoxication resulting from ingestion can lead to hallucinations, hyperthermia, convulsions, flaccid paralysis, and death. In the absence of any other sign of toxicity, we reassured the parents and discharged the child. The mydriasis disappeared spontaneously within 3 days.

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Frequency of Intraocular Pressure Changes after Phacoemulsification in Patients having Age Related Cataract  
(A study of 130 patients)

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Romana Rahman MBBS⁴, Muhammad Idris MBBS⁵

ABSTRACT
Objective: To determine the frequency of Intraocular pressure changes after Phacoemulsification in patients having age related cataract.

Materials and Methods: This study was conducted at ophthalmology department, PGMI, Lady Reading Hospital, Peshawar, from 15th Sep, 2010 to 15th June, 2011. 130 patients suffering from age-related cataract with age range from 45 to 75 years were selected, mean age of the patients were 52 years with standard deviation ± 2.57 in which 69 (53%) were male and 61 (47%) were female. Informed consent was obtained from each patient. 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 biomicroscopy. Biometry and viral profile was done. All the patients were operated by Phacoemulsification and intraocular lens were implanted in the capsular bag. Pre and postoperative intraocular pressure was measured with the help of applanation tonometer. The first postoperative intraocular pressure was taken as final reading.

Results: In this study mean age of the patients was 52 years with standard deviation ± 2.57, 53% patients were male and 47% patients were female. Pre operative intra ocular pressure was analyzed as 42% patients had IOP ranged from 11-16 mmHg and 58% patients had IOP ranged from 17-21 mmHg. Post operatively change in the intra ocular pressure was increased in 36% patients by 5 mmHg or more while in 64% patients IOP remained the same.

Conclusion: Increase in intraocular pressure occurs frequently after uncomplicated phacoemulsification cataract surgery performed for patients with age related cataract. This rise in intraocular pressure can cause damage to the ocular structures. Intraocular pressure is not routinely measured after phacoemulsification. It is recommended that intraocular pressure should be measured on the first postoperative day after phacoemulsification routinely. Moreover, the patients should also be given pressure lowering medicines in the postoperative period after phacoemulsification to prevent ocular damage due to intraocular pressure spikes.

Key words:  
Intraocular Pressure, phacoemulsification, age related cataract.

INTRODUCTION
Any congenital or acquired opacity in lens capsule or its substance, irrespective of the effect on vision is called cataract. It is divided mainly into congenital and acquired types of the acquired type the most is age related cataract. Age related cataract is the one which is associated with aging².

Cataract is the leading cause of blindness in the world affecting approximately 20 million people and this figure was expected to increase to 50 million people by the year 2010². Cataract is also the most common cause of blindness (51.5%) in Pakistan³. According to a study the prevalence of age related cataract in Pakistan is 20.9%⁴.

Visually significant cataracts can lower quality of life related to health due to its effects on visual, functional, and psychological disability⁵. Cataract surgery is the most common refractive surgery performed in aging individuals⁶. Three main methods of surgery for management of cataract are phacoemulsification, extra capsular cataract extraction and manual small incision cataract surgery¹. Phacoemulsification, which was introduced by Kelman in 1967, has become the main surgical procedure for the management of cataract⁷. Rise in intraocular pressure (IOP) occurs frequently after uncomplicated phacoemulsification surgery⁸. Pressure rise to more than 30 mm Hg with in the first 24 hours post operatively are also well reported⁹. Ophthalmic visco surgical devices (OVDs) plays many important functions in phacoemulsification, which includes facilitation of
Frequency of Intraocular Pressure Changes after Phacoemulsification in Patients having Age Related Cataract

capsulorrhexis, maintenance of anterior chamber, protection of corneal endothelium, acting as tamponade for intraocular structures, protection of posterior capsule from sharp edge of broken nuclear fragments, and filling of capsular bag before Intraocular lens implantation. OVDs used in phacoemulsification can cause various adverse effects, the most common and potentially dangerous of them is the transient rise in IOP in post-operative period. OVDs cause elevation of IOP in the postoperative period due to clogging of trabecular meshwork.

Phacoemulsification is the surgical procedure of choice for management of age related cataract and rise in IOP is one of the common complications of this type of surgery. IOP is not routinely checked after phacoemulsification. The rationale of our study is to find out the change in IOP postoperatively in patients having age related cataract undergoing phacoemulsification and to make it a routine practice to check IOP postoperatively because high IOP may damage the ocular structures and this damage may be irreversible.

MATERIALS AND METHODS

This cross sectional study was conducted in department of Ophthalmology, PGMI, Lady Reading Hospital, Peshawar, from 15th Sep, 2010 to 15th June, 2011. 130 patients suffering from age related cataract with age range from 45 to 75 years were selected, mean age of the patients were 52 years with standard deviation ± 2.57, in which 69 (53%) were male and 61 (47%) were female (Table II).

Preoperative visual acuity (Table III) and intraocular pressure (Table IV) were checked. Informed consent was obtained from each patient. 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. Biometry and viral profile was done. All the patients were operated by Phacoemulsification and IOL were implanted in the posterior chamber. Diabetics, hypertensive, glaucomatous, old cases of ocular trauma and co-ocular morbidity patients were excluded from the study.

Pre and postoperative intraocular pressure was measured with the help of application tonometer. The first postoperative intraocular pressure was taken as a final reading.

RESULTS

This study was conducted at Department of Ophthalmology, PGMI, Lady Reading Hospital, Peshawar. A total of 130 patients were included in this study. Age distribution among patients 59(46%) were mostly in age range from 51-60 years followed by 37(28%) patients above 60 years and 34(26%) patients were in age range from 40-50 years. Mean age was 52 years with standard deviation ± 2.57. (Table I) Gender distribution among patients 69 (53%) were male while 61 (47%) patients were female. (Table II)

Visual acuity findings among patients 102 (78%) ranged from < 6/18 – 6/60 while 28(22%) patients had visual acuity ranged from counting fingers to perception of light. (Table III)

Preoperative intraocular pressure (IOP) in 55 (42%) patients ranged from 11-16 mmHg while in 75 (58%) patients it was from 17-21 mmHg. Mean intraocular pressure (IOP) was 17 mmHg with standard deviation ± 1.34 (Table IV). Post operatively change in the intraocular pressure was analyzed as in 47 (36%) patients intraocular pressure had increased by 5 mmHg or more. while in 83 (64%) patients Intraocular pressure was not changed. Mean intraocular pressure after the change was 19 mmHg with standard deviation ± 2.78 (Table V)

Postoperative change in the intraocular pressure among 47(36%) patients was compared with age distribution as IOP was increased by 5mmHg or more in 10(8%) patients who were in age range between 40-50 years, 24(18%) patients who were in age range from 51-60 years and 13(10%) patients who were above 60 years of age. (Table VI)

Postoperative change in the intraocular pressure among 47(36%) patients was compared with gender distribution as IOP was increased by 5mmHg or more in 23(18%) male patients and in 24(18%) female patients. (Table VII) Postoperative change in the intraocular pressure among 47(36%) patients was further analyzed as IOP was increased by 5mmHg or more in 22(17%) patients who had IOP ranged from 11-16 mmHg and 25(19%) patients who had IOP ranged from 17-21 mmHg. (Table VIII)

Table I showing age wise distribution. Total 130

<table>
<thead>
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<th>Age wise distribution</th>
<th>Frequency</th>
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<tr>
<td>40 to 50 years</td>
<td>34</td>
<td>26%</td>
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<td>51-60 years</td>
<td>59</td>
<td>48%</td>
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<tr>
<td>More than 60 years</td>
<td>37</td>
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<td>Total</td>
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Table II showing gender wise distribution. Total 130

<table>
<thead>
<tr>
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<tr>
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<tr>
<td>Female</td>
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<td>Total</td>
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</table>
DISCUSSION

Our study shows that increase in intraocular pressure (IOP) occurs frequently after uneventful phacoemulsification surgery. IOP raises in the postoperative period after phacoemulsification, with a mean increase between 5mm Hg and 13 mm Hg. Pressure spikes to even more than 30 mm Hg with in the first 24 hours post operatively.

Our results shown that most of the patients 46% were in age ranged from 51-60 years, 28% patients were above 60 years and 26% patients were in age ranged from 40-50 years. Similar results were found in study done by Waseem et al in which 50% patients were in age ranged from 51-60 years, 22% patients were above 60 years and 28% patients were in age ranged from 40-50 years.10

In our study there was no significant difference in gender distribution as 53% patients were male and 47% patients were female. Similar results were found in study conducted by Waseem et al in which 50% patients were male and 50% patients were female.10

Our results shows that 78% patients had visual acuity ranged from <6/18 – 6/60 while 22% patients had visual acuity ranged from counting fingers to perception of light. Similar concept has been explained in Unal M et al.8 In his study 80% patients had visual acuity ranged from < 6/18 – 6/60 while 20% patients had visual acuity ranged from counting fingers to perception of light.8

Our study shows that 42% patients had Intra ocular pressure (pre operatively) ranged from 11-16 mmHg while 58% patients had Intra ocular pressure (pre operatively) ranged from 17-21 mmHg. Similar results were coated in study done by Antano SF et al in which 38% patients had Intra ocular pressure (pre operatively) ranged from 11-16 mmHg while 62% patients had Intra ocular pressure (pre operatively) ranged from 17-21 mmHg.9 Unal M et al had shown
that occurrence of intraocular pressure rise after phacoemulsification is (9 out of 43 patients) which was nearly 21%. Our results shows that rise in intraocular pressure was found in 36% patients which was due to lack of knowledge and facilities. Similar results were also coated in another study done by Antano SF et al in which 25% incidence of rise in intraocular pressure after phacoemulsification was recorded.

Our results shown that there is no significance of age in rising intraocular pressure after phacoemulsification because in our study IOP was increased by 5mmHg or more in 8% patients who were in age ranged from 40-50 years, 18% patients who were in age ranged from 51-60 years and 10% patients who were above 60 years of age. Similar concept was explained in study done by Unal M and Antano in their studies.

Our study also shows that there is no significant difference of gender in rising intraocular pressure after phacoemulsification because in our study IOP was increased by 5mmHg or more in 18% male patients while on the other hand IOP was increased by 5mmHg or more in 18% female patients. Similar finding were observed in study done by Unal M in which IOP was increased up to 6mmHg in 20% male patients and 17% in female patients. In another study done by Antano had shown increase in IOP was found in 22% male patients and 23% in female patients.

Our study shows that IOP was increased by 5mmHg or more in 17% patients who had IOP ranged from 11-16 mmHg and 19% patients who had IOP ranged from 17-21 mmHg. Similar results were shown in study done by Antano in which IOP was increased by 5mmHg or more in 16% patients who had IOP ranged from 11-16 mmHg and 14% patients who had IOP ranged from 17-21 mm Hg. Similar results were also quoted in another study done by Waseem et al in which IOP was increased up to 5mm Hg in 15% patients who had IOP ranged from 11-16 mm Hg and 13% patients who had IOP ranged from 17-21 mm Hg.

CONCLUSION
Increase in intraocular pressure occurs frequently after uncomplicated phacoemulsification surgery performed in patients with age related cataract. This rise in intraocular pressure can damage ocular structures. Intraocular pressure is not routinely measured after phacoemulsification. It is recommended that intraocular pressure should be measured on the first post operative day that is 24 hours after phacoemulsification routinely. More over the patients should also be given pressure lowering medicines in the post operative period after phacoemulsification to prevent ocular damage due to intraocular pressure spikes.

REFERENCES:
INTRODUCTION

Cataract accounts for 80% cases of avoidable blindness affecting an estimated 20 million people. Cataract surgery is possibly the oldest surgical procedure and now is the most frequently performed surgical procedure in the world. Cataract surgery continue to evolve over time, embracing smaller incision that allow quicker recovery, better wound strength and increased surgical control, resulting in lower complication rate and better visual outcomes. To manage the large backlog of cataract blindness effectively, cost effective, high quality and high volume surgery is needed in community eye care centers. The cost effectiveness is related to short operative time, potential for high volume, high success rates and the low cost of consumables. However when success rates are low, cost effectiveness is reduced. Procedures which are affordable, practicable, applicable and sustainable everywhere can be adopted to obtain good surgical and visual outcomes in the setting of developing countries. The visual outcomes of patients who undergo conventional extracapsular cataract extraction at country hospital are not excellent, but the surgical complications are minimal. On the other hand the visual outcomes of patients who undergo phacoemulsification are good, but the complications rates are slightly higher. Extracapsular cataract extraction can result in various intraoperative and postoperative complications. Intraoperative complications can be posterior capsular rent with or without vitreous prolapse, posterior loss of lens fragments, posterior dislocation of intraocular lens, sudden rise of intraocular pressure or even suprachoroidal hemorrhage. Postoperative complications can be corneal edema, iris prolapse, inflammatory glaucoma, endophthalmitis, posterior capsular opacification, malpositioning of intraocular lens, cystoid macular edema or even retinal detachment.

The aim of this study is to review various complications which have occurred intraoperatively or postoperatively and final visual outcome in patients undergoing extracapsular cataract extraction in our rural setting.

MATERIAL AND METHODS.

This non-randomized interventional study was conducted at Comprehensive Eye Care Unit of District Head Quarter Hospital, Battagram, Khyber Pakhtoonkhwa from October 2009 to December 2010. A total of 1150 patients were operated by a single surgeon using the same technique for all the patients, included after obtaining their informed consent.
Inclusion criteria:
All patients with operable cataracts in one or both eyes affecting their routine activities.

Exclusion criteria:
i. Patients with afferent papillary defect, total and relative.
ii. Central corneal opacities

Patients were admitted through OPD. Thorough preoperative evaluation was carried out with Snellen chart or light perception or projection, Slit lamp, direct and indirect ophthalmoscopes.

Systemic evaluation including blood pressure check up and diabetes screening were done. Blood samples of all patients were tested for Hepatitis B and C viruses. Keratometry and intraocular lens powers were calculated. Two types of anesthesia was used i.e. peribulbar and subconjunctival anesthesia depending upon the patients choice and tolerability. In cases of peribulbar anesthesia ocular compression was achieved through compressed cotton balls.

Conventional extracapsular cataract extraction with posterior chamber intraocular lens implantation was the surgical procedure. Intraoperative complications were noted. Post operative follow up was carried out on 1st, 2nd, 4th and 6th weeks. Final visual acuity on the last follow up after removal of stitches was noted.

RESULTS
Total of 1150 patients were operated. Out of these 656 (57.04%) were male and 494(42.9%) were females (Table 1). Mean age was 58 years. Hence comprehensive eye care unit of District Headquarters Hospital, Battagram is a unit where all surgical consumables like intraocular lenses, sutures, viscoelastics etc are provided free of cost. To get benefits of these free facilities patients come from far flung areas.

Preoperative visual acuity of 6/60 or less was noted in 78%, 6/18-6/60 in 18% and 6/9-6/18 in 4% of cases (Table 2). Mature cataract was the most common presentation i.e. 908 (78.9%) of cases, followed by cortical 138 (12%), nuclear 69 (6%) and posterior subcapsular in 35 (3.04%) of cases (Table 3).

The most common associated diseases were systemic hypertension in 59 (5.12%), diabetes mellitus in 41 (3.6%), glaucoma in 36 (3.12%), pterygium in 20 (1.73%) and chronic dacryocystitis in 26 (2.26%). HBsAg positive was positive in 9(0.78%) and HcV positive were 93 (8.03%).( Table 4)

Posterior capsular rent was the most common intraoperative complication occurring in 23 (2%) patients, with out vitreous prolapse in 14 (1.21%) and with vitreous prolapse in 9 (0.78%), followed by sudden rise of intraocular pressure and shallowing of anterior chamber without vitreous loss in 7(0.6%) patients, in these patients the most common cause was cough and breathing difficulty (Table 5).

Postoperative complications were in following order of frequency, Corneal edema 26 (2.26%), iris prolapse 9 (0.78%), endophthalmitis 2(0.17%), pupil block inflammatory glaucoma 3(0.26%) and Intraocular lens drop 2(0.17%). (Table: 6)

Final visual acuity achieved at 6th weeks after removal of stitches were good in (6/6- 6/9) in 677(69.65%) patients, fair (6/9-6/18) and in 184 (18.93%) these patients had either developed
Table 6: Postoperative complications

<table>
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<th>Complications</th>
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<td>Corneal edema</td>
<td>26</td>
<td>2.26%</td>
</tr>
<tr>
<td>Iris prolapse</td>
<td>9</td>
<td>0.78%</td>
</tr>
<tr>
<td>Endophthalmitis</td>
<td>2</td>
<td>0.173%</td>
</tr>
<tr>
<td>Pupil block inflammatory glaucoma</td>
<td>3</td>
<td>0.26%</td>
</tr>
<tr>
<td>Intraocular drop of lens</td>
<td>2</td>
<td>0.17%</td>
</tr>
</tbody>
</table>

Table 7: Visual acuity after removal of stitches

<table>
<thead>
<tr>
<th>Visual acuity</th>
<th>Number</th>
<th>%age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good (6/6-6/9)</td>
<td>677</td>
<td>69.65%</td>
</tr>
<tr>
<td>Fair (6/9-6/18)</td>
<td>184</td>
<td>18.93%</td>
</tr>
</tbody>
</table>

Intraoperative or postoperative complications or had some ocular disease like corneal opacity or age related macular degeneration, poor (6/24-6/60), in 58(5.96%) in these causes were the same as mentioned earlier, very poor (6/60), hand movement in 41(4.21%) and just perception of light in 12(1.26%) in these patients causes were retinal detachment, advanced age related macular degeneration and optic atrophy. (Table. 7) were the main causes of total 1150 patients; 178 patients did not complete their follow up.

DISCUSSION

In developing countries blindness caused by cataract accounts for 90% of cases 10. Even though lots of medical treatment for cataract have been studied and many treatment modalities are described 11 there is no medical treatment that has definitely been proven to delay, prevent or reverse the development of cataract in adults. Currently, therefore, the only treatment available for cataract is surgery.

The first extra capsular cataract extraction was performed by a French surgeon Jacques Daviel in 175312. In 1865, the German Ophthalmologist Von Graefe refined the operation by removing the lens through a much smaller linear incision in the sclera. The two inventions that made extracapsular cataract extraction preferable again were the operating microscope and the intraocular lens. The first eye surgery performed with an operating microscope was done in Portland, Oregon, in 1948; in the same year, a British Ophthalmologist named Harold Ridely implanted the first intraocular lens in the eye of cataract patient13. Between 1948 and 1980s, manual expression was the standard form of extracapsular cataract extraction. Although phaco-emulsification was first introduced in 1967, it was not widely accepted at first because it requires special technique that takes time for the surgeon to learn as well as expensive specialized equipments. The manual expression technique, however, is still widely used in developing countries with large number of patients and limited hospital budgets 1, 14.

In our study we found that incidence of intraoperative complications closely compare with studies done by Chetkara and Smerdon. i.e. posterior capsular rupture was the most common complication accounting for 2% and raise of intraocular pressure and iris prolapse 0.6%. Ionides and Minnisan have also studied intraoperative complications during extracapsular cataract extraction and have noted the posterior capsular rent to be 4% i.e. higher that in our study 15, 16. We did not come across other intraoperative complications like posterior loss of lens fragments, nucleus drop or suprachoroidal hemorrhage.

Postoperative complications with in 6 weeks of surgery which we have encountered in our study were corneal edema, iris prolapse, endophthalmitis, inflammatory glaucoma and intraocular lens drop. Allen and Zhang in their study extracapsular cataract extraction: prognosis and complications with and without posterior chamber intraocular lens implantation have also noted these complications nearly in the same rate as in our study except an inflammatory glaucoma which they have not observed17. In our study the only reason for inflammatory glaucoma, pupil block, was non-compliance of those patients with postoperative medications.

In our study we have looked for the visual acuity after 6 weeks and removal of stitches. Most of patients i.e. 71.8% have achieved good vision, 20.98% fair vision, 5.96% poor vision, these patients had mostly preoperative reasons for poor vision like corneal opacities, age related macular degeneration or glaucoma. Few patients had poor vision due to intraoperative or postoperative complications. These results are comparable with studies conducted by Tesfaye and his co-workers and Albanis and Earnes.

CONCLUSION

Manual Extracapsular Cataract Extraction with intraocular lens implantation is a safe and effective technique for the treatment of cataract in peripheral set up.

REFERENCES


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**Medicinal Value of Fruits**

**Pomegranate (Punica Granatum)**

A symbol of health, fertility and long life

Zainab Inam, Nowshera

**Powerful Health Benefits of the Pomegranate**

Originally, a native fruit of Persia, it is a dense, antioxidant rich fruit which has been recognized as a symbol of health, fertility and long life. It contains high levels of flavonoids and polyphenols, potent antioxidants offering protection against heart disease and cancer. A glass of pomegranate juice has more antioxidants than green tea, blueberries, and cranberries.

This fantastic little fruit is full of compounds called *punicalagins*, to benefit the heart and blood vessels. They not only lower cholesterol, but also lower blood pressure and increase the speed at which heart blockages (atherosclerosis) melt away.

Recent medical research studied heart patients with severe carotid artery blockages. They were given an ounce of pomegranate juice each day for a year. Not only did the participants’ blood pressure lower by over 12 percent, but there was a 30 percent reduction in atherosclerotic plaque. In another studies, potent antioxidant compounds found in pomegranates have shown to reduce platelet aggregation and naturally lower blood pressure, factors that prevent both heart attacks and strokes.

Not only are pomegranates good for your heart and blood vessels, they have been shown to inhibit breast cancer, prostate cancer, colon cancer, leukemia and to prevent vascular changes that promote tumor growth in lab animals. Several *in vitro* studies have shown this remarkable anti-cancer effect. Pomegranate juice contains phytochemical compounds that stimulate serotonin and estrogen receptors, improving symptoms of depression and increasing bone mass in lab animals. Those who are looking to prevent these ailments incorporate the powerful components of pomegranates into their diet.

- Most powerful anti-oxidant of all fruits
- Potent anti-cancer and immune supporting effects
- Inhibits abnormal platelet aggregation that could cause heart attacks, strokes and embolic disease
- Lowers cholesterol and other cardiac risk factors
- Lowers blood pressure
- Shown to promote reversal of atherosclerotic plaque in human studies
- May have benefits to relieve or protect against depression and osteoporosis.

For those who still have LDL cholesterol above 100 mg/dl after dietary intervention, Scientists designed the mixture of high quality plant sterols and pomegranate (LDL Protect) as cholesterol-lowering and cardiac protective compounds. No other product in the market offers this combination of ingredients.

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INTRODUCTION:
Posterior capsular opacification is one of the major complications after the extracapsular cataract extraction or phacoemulsification\(^1\). Posterior capsular opacification is caused by proliferation and migration of residual lens epithelial cells which can produce visual loss through two mechanisms\(^2\). They can form swollen, abnormal shaped lens cell called Elschnig’s pearls, which migrate over the posterior capsule onto the visual axis\(^3\). Capsular fibrosis, due to fibrous metaplasia of epithelial cells, is less common and usually appears earlier than Elschnig’s pearls. Standard treatment of posterior capsular opacification consists of making an opening in the posterior capsule using Neodymium: Yatrium Aluminium Garnet laser (Nd: YAG laser)\(^4,5\).

Nd: YAG laser works on the principle of photodisruption. The laser shots produce plasma around the target spot which bursts producing a shock wave resulting in a hole in the posterior capsule\(^6\). The Nd: YAG laser in pulse mode was adopted for use in ophthalmology, and the first posterior capsulotomy in the human eye was performed\(^7\). The Nd: YAG laser capsulotomy is a very simple procedure which can be performed on outdoor basis, it saves a lot of effort and time both on the part of surgeon as well as patient. The rise in intraocular pressure can be controlled by using topical ß-blockers\(^8\). Topical 0.5% timolol maleate and 0.5% levobunolol are ß-blockers, which are known to effectively control the rise of intraocular pressure\(^9\) and are used twice daily. All the ß-blockers are the preferred medication in lowering IOP after YAG laser capsulotomy because of their easy dosage and reliable results. This study was conducted to evaluate the change in visual acuity and intraocular pressure (IOP) after Nd: YAG laser posterior capsulotomy.

MATERIAL AND METHODS:
This study was conducted at out patient department of LRBT Free Secondary Eye Hospital Mansehra from May to November 2012. A total of 200 patients undergoing Nd: YAG laser posterior capsulotomy...
capsulotomy were included in the study. Purposive (non-probability sampling) technique was used in this study.

**Inclusion criteria**
1. All patients having uneventful cataract surgery with posterior chamber IOL implant followed by development of posterior capsular opacification.
2. Patients having more than six month’s follow-up after cataract surgery.

**Exclusion criteria**
1. Patients below 20 years of age.
2. Patients having less than six month’s follow-up after cataract surgery.
3. Extra capsular cataract extraction without IOL implantation.
4. Known cases of glaucoma like POAG and primary angle closure glaucoma (PACG).
5. Dislocated/sub-luxated IOL.
6. IOL implant in traumatic cataract.
7. Patients having combined procedure (Trabeculectomy with PC IOL).
8. Patients diagnosed as a case of diabetic retinopathy or any other retinal disease.
9. Cases with postoperative complications such as endophthalmitis.

Approval was taken from ethical committee of LRBT Central office Karachi, before starting the study. 200 patients suffering from posterior capsular opacity in which 128 (60%) were male and 72 (40%) were female (Table I) with age ranging from 40 to 83 years were selected in which most patients (35%) were in the age ranging between 60 to 69 years (Table II).

An informed written consent was obtained from the patient. After enrollment in the study, detailed history, visual acuity using Snellen’s visual acuity chart, slit lamp examination, IOP by Goldman applanation tonometer, direct and indirect ophthalmoscopy, and B Scan ultrasonography done in cases of dense PCO carried out before YAG laser capsulotomy. The patients evaluated for inclusion criteria. Patients were properly educated about the procedure.

The patients were subjected to measurement of visual acuity by standard Snellen’s acuity chart and intraocular pressure measurements in mm of Hg on Goldman’s applanation tonometer every time by same person and on the same apparatus. Before treatment 1% tropicamide (Mydriacyl) eye drops were instilled to dilate the pupil and the cornea was anaesthetized with topical application of 0.5% proparacaine hydrochloride (Alcaine) eye drops. Q-Switched Nd: YAG laser (SYL9000 YAG laser system) was used with Abraham’s posterior capsulotomy lens to make a hole of 3-4mm in the posterior capsule using 1.5 to 5mJ per pulse. The energy and pulses were increased gradually according to thickness of capsule until an opening was achieved.

Following the capsulotomy 0.1% diclofenic sodium (Naclof) eye drops were advised thrice in a day for one week and anti glaucoma therapy advised when needed. Then patients were reviewed for assessment of visual acuity and measurement of IOP one hour after and one week after the laser treatment.

The cases that satisfied the inclusion criteria were included. Data was entered and analyzed using SPSS version 10. Mean and standard deviation were calculated for numerical variable i.e. age wise percentages and frequencies were computed for categorical variable like age of the patients and sex etc. The entire variables were presented in the form of tables and charts. A p-value <0.05 was considered as statistically significant.

**RESULTS:**
This study was conducted at out-patient department of LRBT Free Secondary Eye Hospital Mansehra in which a total of 200 patients undergoing Nd: YAG laser posterior capsulotomy were included in the study and the results were analyzed.

Age distribution among 200 patients were analyzed as n=48 (24%) patients were in age ranged between 40 - 49 years, n=50 (25%) in age range between 50-59 years, n=70 (35%) in age range between 60 -69 years and n=32(16%) in age equal or above 70 years. Mean age was 58.58 years with standard deviation ±11.56 SD. Minimum age was 40 years while maximum age was 83 years.

The gender distribution among 200 patients was analyzed as n= 128(60%) patients were males while n=72(40%) patients were females. There were n=113(56.5%) patients with PCO in the right eye while n=87(43.5%) patients had PCO in the left eye after cataract extraction with posterior chamber intraocular lens implantation.

The pre Nd:YAG laser posterior capsulotomy visual acuity of the patients was 6/12 in n=26(13%) patients, 6/18 in n= 37(18.5%) patients, 6/24 in n=45(22.5%) patients, 6/36 in n=67(33.5%) patients, 6/60 in n=13(6.5%) patients and visual acuity worse than 6/60 in n=12(6%) patients.(Table III).

The visual acuity after one week of Nd:YAG laser posterior capsulotomy , was 6/6 in n=23 (11.5%) patients,6/9 in n= 34 (17%) patients, 6/12 in n=67 (33.5%) patients, 6/18 in n=33 (16.5%) patients, 6/24 in n=21 (10.5%) patients, 6/36 in n=13 (6.5%) patients and 6/60 in n=9 (4.5%) patients. (Table IV)

There was improvement in visual acuity of two or more lines on Snellen’s chart following Nd:YAG laser posterior capsulotomy in n=169(84.5%) patients whereas n=31 (15.5%) patients showed no
improvement. (Table V)

The pre Nd: YAG laser posterior capsulotomy, intraocular pressure with Goldman applanation tonometer of the patients was 6-10 mmHg in n=48 (24 %) patients, 11-15 mmHg in n=124 (62 %) patients, 16-20 mmHg in n=28 (14 %) patients and IOP more than 20 mmHg was zero. (Table VI), so all those patients were included who were having pre treatment IOP between 6 and 20 mmHg.

The results after one week of Nd: YAG laser posterior capsulotomy, assessment of change in intraocular pressure measured with Goldman applanation tonometer showed no change in IOP in n=104 (52 %), increase of 1-2 mmHg IOP in n=36 (18 %) patients, 3-4 mmHg in n=32 (16 %) patients, 5-6 mmHg in n=10 (5 %) patients, 7-8 mmHg in n=8 (4 %) patients, 9-10 mmHg in n=6 (3 %) patients and increase in IOP more than 10 mmHg in n=4 (2 %). (Table VII)

The above result shows that 52% of the patients showed no change in IOP after Nd: YAG laser posterior capsulotomy while the remaining 48% patients showed some degree of change in IOP after Nd: YAG laser posterior capsulotomy in which most of the increase was in the range of 1-4 mm Hg in n=68 (34 %) patients and only 14% of the patients showed increase in IOP more than 5 mmHg which needed special attention and regular follow up for proper control of IOP.

**DISCUSSION:**

In ophthalmology, Nd: YAG laser posterior capsulotomy is a routine procedure, since up to 40% of the patients submitted to cataract surgery with IOL implantation develop posterior capsule opacification despite the progress made in surgical techniques.

Although Nd: YAG laser is considered to be a safe procedure, it can cause several complications, namely retinal detachment, iritis, macular edema, IOL cracks and pits and IOP spike. In the present study we

Table I: Showing gender distribution (N=200)

<table>
<thead>
<tr>
<th>Gender</th>
<th>No of Patients</th>
<th>% age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>128</td>
<td>60%</td>
</tr>
<tr>
<td>Female</td>
<td>72</td>
<td>40%</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table II: Age range of the respondents (N=200)

<table>
<thead>
<tr>
<th>Age</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 to 49 years</td>
<td>48</td>
<td>24%</td>
</tr>
<tr>
<td>50 to 59 years</td>
<td>50</td>
<td>25%</td>
</tr>
<tr>
<td>60 to 69 years</td>
<td>70</td>
<td>35%</td>
</tr>
<tr>
<td>&gt; 70 years</td>
<td>32</td>
<td>16%</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>100%</td>
</tr>
</tbody>
</table>
compare the change in IOP and visual acuity in patients undergoing Nd: YAG laser for posterior capsule opacification after extracapsular cataract extraction/ phacoemulsification and posterior chamber intraocular lens implantation.

There are 200 patients included in our study with mean age range of patients of 58.58 ±11.56 years. The mean age of such patients in one international study done in Manchester Eye hospital, UK was 75.2 years. The mean age of patients in one national study conducted at PGI/LRH Peshawar was 54.78 ±13.51 years.

According to our study the mean duration between the cataract surgery and Nd: YAG laser posterior capsulotomy was found to be 2.143± 1.223 years. In an another study it was found that the duration between the cataract surgery and Nd:YAG laser posterior capsulotomy was between 10 to 15 months. The majority of the patients (46%) had posterior capsular opacification between 3 months to 12 months post operatively.

Apple DJ has noted that the incidence of PCO up to 50% by two years post operatively, 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.

The pre Nd:YAG laser posterior capsulotomy, distant visual acuity of the patients was 6/12 in n=26(13%) patients, 6/18 in n= 37(18.5%) patients, 6/24 in n=45(22.5%) patients, 6/36 in n=67(33.5%) patients, 6/60 in n=13(6.5%) patients and visual acuity worse than 6/60 in n=12(6%) patients while in an international study of Greece, 2.9% patients had VA between 20/32 and 20/60, 6.6% patients had VA 20/40, 14.7% had VA between 20/50 and 20/60, 20.6% had VA 20/80 and 26.6% had VA 20/100. While in a local national study, 80.4% of patients had pre Nd: YAG laser VA > 6/9, among them 52.4% had VA better than 6/60.

In our study the post Nd:YAG laser posterior capsulotomy, the distant visual acuity of the patients was 6/6 in n=23 (11.5%) patients, 6/9 in n= 34 (17%) patients, 6/12 in n=67 (33.5%) patients, 6/18 in n=33 (16.5%) patients, 6/24 in n=21 (10.5%) patients, 6/36 in n=13 (6.5%) patients and 6/60 in n=9 (4.5%) patients. The study of Greece showed that out of 34 patients only 1(2.9%) had post treatment VA 20/80 while other patients (85.3%) had VA better than 20/60 and concluded that Nd: YAG laser capsulotomy seems to be a safe and effective procedure for eyes that have previously undergone combined phacoemulsification and vitrectomy surgery. A national 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%) patients who had VA 6/6 – 6/12.

Regarding the improvement in the final VA of two or more lines on Snellen’s chart, 169(84.5%) patients showed improvement while only 31 (15.5%) patients had no improvement in this study. Similar results were also found in a recently conducted study in LRH Peshawar, which showed similar improvements in 91% of patients whereas, 9% of patients showed no improvement in the final visual acuity.

CONCLUSION:

In our study it is concluded that visual acuity in patients who had developed posterior capsular opacity after cataract extraction with posterior chamber intraocular lens implantation is better after Nd: YAG laser posterior capsulotomy than the visual acuity before treatment with Nd: YAG laser posterior capsulotomy. Regarding the change in IOP after Nd:YAG laser posterior capsulotomy, 104 (52%) of the patients showed no change in IOP, 68 (34%) patients showed 1-4 mmHg increase in IOP, while 28(14%) patients showed increase more than 5mmHg rise in IOP which needed special attention and regular follow up till IOP was controlled.

REFERENCES
11. Rahil N, Rehman R, Malik R, Visual outcome after the use of...


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**Optic Disc may be Sinking in Glaucoma & not Cupping**

Syed S. Hasnain M.D. Porterville California, U.S.A

*You will find pictures A and B of the optic disc taken from Becker-Shaffer’s Diagnosis and Therapy of the Glaucomas by Kolker and Hetherington (Mosby 1976) page 169.*

The caption underneath the pictures reads: Progressive cupping of left eye in a 18-year old woman. A, 0.4 disc - diameter progressed to B, 0.7 disc-diameter at pressures of 38 to 46 mmHg. If the findings stating that the 0.4 cup in A has progressed to 0.7 in B are true, then the 150-year old cupping theory is correct.

**Let us closely observe these two pictures again.** Picture B is 24 % larger image size compared to picture A (photographer’s error). Therefore, because of this discrepancy in viewing, the cup size in B would be larger. In actuality, the contour and margins of said cup are intact in B, therefore, the cup size in B has neither enlarged nor distorted.

**Then what happened?**

Let us look again: The blood vessels on the entire disc margin in B are not straight as they were in A. Instead, the blood vessels are curving inward in pursuit of the sinking disc, more noticeable the superior vessels. This inward turning of the blood vessels clearly indicate that disc is sinking, and not cupping (as mistakenly described in the textbook).
Major Review of the Applications of Femtosecond Laser in Ophthalmology
Rao M. Rashad Qamar FCPS, FRCS1, M. Imran Saleem MBBS2
Muhammad Farhan Saleeem MBBS3

ABSTRACT
Objective: The objective of this study was to review the current ophthalmic literature regarding the applications of femtosecond laser in the field of ophthalmology.
Study Design: Literature Review.
Setting: Eye Unit-I, B.V. Hospital, Bahawalpur; Pakistan.
Results: Femtosecond lasers offer the ophthalmologist an ability to cut the tissues at various depths, with different patterns and minimal collateral tissue injury. This technology has dramatically changed the corneal refractive surgery and is anticipated to do the same for the cataract surgery as well. The companies i.e. the IntraLase, the FEMTEC, the OptiMedica, the LenSx and the LensAR have developed their femtosecond laser systems to be used for different ophthalmic surgical procedures. These systems can perform the corneal incisions, the capsulotomy, and the lens fragmentation.
Conclusion: Femtosecond laser provides a more precise and safer approach towards ocular surgery.
Key Words: Cataract surgery; corneal refractive surgery; Femtosecond laser

INTRODUCTION:
Lasers are being used in the field of ophthalmology since early 70s. Kransov 1 in 1975 reported the use of ruby laser (wavelength 694nm) to create micro-puncture of the anterior capsule of the crystalline lens, allowing the release of the lens matter and gradually leading to resorption of the cataract. Ultraviolet lasers having wavelength between 193 and 351 were the next target of investigators to look into as an aid for corneal and cataract surgery. The infrared part of the spectrum was finally adopted in 1980s as a safer mode for ocular surgeries 2. Nd-YAG laser was the first laser to be used for peripheral iridotomy, posterior capsulotomy and pupillary membrane lysis. Aron-Rosa and Aron were the pioneers in this field as they used Nd-YAG laser to perform anterior and posterior capsulotomy in order to prevent the development of a Posterior Capsular Opacification (PCO) after cataract surgery. Laser assisted anterior capsulotomy never gained popularity owing to complications of intraocular inflammation, increase in intraocular pressure and post-laser poor mydriasis. 2

Lasers have been applied to photolysis and photodisruption of the crystalline lens. Peyman and Katoh through their work showed that when laser light is focused directly onto the nucleus of the crystalline lens, an optical breakdown of the lens material is observed 6. Erbium-YAG lasers were subsequently used by different researchers with systems of varying energy levels and pulse duration in order to decrease the energy use and resultant decline in incidence of endothelial cell damage 2. Photolysis system were subsequently introduced by Dodick. In these systems, laser energy is transferred to a titanium target which is installed within a laser/aspiration handpiece 7. This leads to the formation of plasma at the tip of the target. The plasma thus formed causes the optical as well as acoustic breakdown of the material through shockwave production 8.

Clinical trials performed on these systems report a high success rate, decreased complication rate and a shorter operation time 9. However adoption among the ophthalmologists is not widespread as phaco-emulsification is the preferred method of cataract removal. Femtosecond laser uses a shorter pulse time (10-15 seconds versus 10-9 seconds) when compared to argon (photocoagulation), excimer (photoblation), and Nd-YAG (photodisruption) lasers. A shorter pulse time decreases the energy per unit time thus leading to a decreased energy output for a given effect 10. This property of femtosecond laser is especially important for corneal refractive surgery and cataract surgery. This allows the surgeon to preserve the ocular structures including cornea, iris and capsular bag from untoward complications of conventional procedures and
Femtosecond laser works essentially by vaporizing the targeted tissues through the formation of plasma and micro-cavitation bubbles. These lasers became available for the first time in 2001. Initial application of the femtosecond laser was limited to the creation of corneal flaps during Laser Assisted In-situ Keratomileusis (LASIK)\(^9\). Flaps created by femtosecond laser were observed to be reproducible, uniform, well centered and closer to their intended thickness when compared to the flaps created manually with the help of a microkeratome. Since then, use of femtosecond lasers has been expanded to other procedures including customized trephination penetrating keratoplasty (PKP), anterior/posterior lamellar keratoplasty, tunnel creation for intracorneal ring segments, astigmatic keratotomy. Most recently, femtosecond laser has been applied to cataract surgery.

**Femtosecond laser-assisted cataract surgery:**
Cataract surgery is the most commonly performed ocular procedure throughout the world\(^1\). Approximately 3 million cataract surgeries were performed in the USA during the year 2006 and this number will continue to grow as the population ages. The eye disease prevalence research group in 2004 estimated that 20.5 million Americans and 30.1 million Americans by 2020, will have cataract\(^2\). Until recently, the primary outcome of cataract surgery has been functional vision of 20/40 or better with accuracy of ±1 diopter. However, with current biometry and surgical methods, studies report that only 45% of the patients are within 0.5 diopters of their targeted postoperative refraction, and 6% have more than 2 diopters of residual refractive error\(^3\). With the advent of multifocal and accommodative intraocular lenses, more and more patients are opting for earlier cataract surgery with less tolerance for visual impairment. At the same time ophthalmologists are facing increasingly high patient expectations for postoperative refractive outcome. Today, the goal of cataract surgery is to achieve near emmetropia. For this reason, femtosecond lasers can improve the results of cataract surgery due to remarkable reproducibility, centration, and safety during cataract surgery. To date, the femtosecond laser systems are engineered to perform four groups of incisions i.e. the capsulotomy, the lens fragmentation, the limbal relaxing incisions and the clear corneal incisions.

**Femtosecond laser-assisted capsulorrhexis:** Use of femtosecond lasers for capsulotomy or laser assisted capsulorrhexis (Fig. 1) has the potential to revolutionize the cataract surgery. Studies show that the size of the capsulorrhexis is of immense importance for an optimal lens positioning and intraocular lens performance. With single-piece aspheric intraocular lens, a small capsulorrhexis of <5.5mm has been shown to cause anterior capsular phimosis and postoperative hyperopic shift\(^4\). At the same time, a too large capsulorrhexis leads to insufficient overlap of the intraocular lens by the capsule thus increasing the incidence of postoperative lens tilt, decentration and posterior capsular opacification, sometimes needing a lens exchange\(^5\). Creating a precise and predictable capsulotomy should reduce the incidence of aforementioned complications (Fig. 2) The construction of a capsulotomy is also important in estimating the effective lens position (ELP). ELP is a value derived from empirical data of the A-constant and the surgeon’s factor.

The size of the capsulorrhexis has a direct relation with the ELP\(^6\). Inappropriate estimation of the ELP is the biggest source of error in intraocular lens power calculation\(^7\). A difference of 1mm in ELP can lead to a refractive error of about 1.25 dipters\(^8\). For toric and multifocal intraocular lenses, the window for error is even smaller. Tilt, decentration or rotation of these lenses in-situ can cause significant optical aberrations including halos and coma effect which are extremely difficult to tolerate\(^9\). With current technology, no tools exist to guide perfect centration of the capsulotomy/capsulorrhexis except the anatomical landmarks e.g. the borders of a dilated pupil or the limbal edge, making the patients having irregularly dilated pupils or corneal haze challenging in this respect. Predictable and controlled positioning of the intraocular lens can be achieved more often when the capsulorrhexis size incision is perfectly sized and precisely centered. This is possible through the use of femtosecond lasers (Fig. 3).

**Femtosecond Laser-Assisted Lens Fragmentation:** Femtosecond lasers can be used to fragment the crystalline lens nucleus. This allows the operating surgeon to skip the difficult steps of phaco-emulsification i.e. the sculpting/ chopping which is a common source of complications during surgery\(^10\). Additionally, patterns of cuts can be placed on the nucleus in order to soften a harder cataract (Fig. 4). These maneuvers are a means to reduce the need for ultrasound energy from the phaco-tip thereby minimizing the risk of capsular complications and corneal endothelial injury\(^11\). There is an added safety benefit of reducing the unnecessary instrumentation and manipulation of the crystalline lens during surgery. Finally, the femtosecond laser treatments may be optimized for the irrigation/aspiration phaco-dynamics to reduce the aspiration flow rate (AFR) and the intraoperative iris prolapse.

**Steps in Femtosecond Laser-Assisted Cataract Surgery:** There are four primary steps of femtosecond laser assisted cataract surgery i.e. the planning, the
engagement, the visualization, customization and the treatment. Two sub-systems that are of critical importance during laser assisted cataract surgery include the docking system (for engagement step) and the image guidance system (for visualization and customization steps). The approach towards these steps is slightly variable between the LenSx, the LensAR, and the OptiMedica laser systems. Some of the salient features are discussed here.

A-The Planning: Before embarking upon cataract surgery, the individual variations in pupil size, the lens thickness, the corneal thickness are to be measured. After initial planning, adjustments are made in real-time by using drag and drop interface with incisional overlays on video as well as cross sectional images. For performing the capsulorrhesis, the planning parameters include the size, the shape and the required centration of the incision. Primary driver for the capsulotomy planning is the intraocular lens.

For performing the lens fragmentation, the parameters of importance are the depth, the pattern and the diameter of the cuts. These are indirectly dependent upon the density and thickness of the cataract. These parameters can be matched to the surgeon’s preferred technique of surgery and thus reduce the phaco time and energy. For performing the limbal relaxing incisions (LRIs), traditional nomograms are used for planning. However, as the effect of pneumatic dissection from cavitation bubbles is quantified. For clear corneal incisions (CCIs), the planning parameters include the location, the depth and the architecture of incision.

B-The Engagement: Prior to delivering the laser, it is necessary to stabilize the patient’s eye relative to the optical system of the laser. During refractive surgery it is accomplished through the use of a suction ring which causes distortion of the globe. Studies comparing the real-time changes in intraocular pressure during this maneuver between femtosecond assisted surgery versus mechanical keratome assisted surgery have shown that the IntraLase interface (Abbot Medical Optics, California, USA) can cause a rise of about 90mmHg while the VisuMax interface (Carl-Zeiss Meditec, California, USA) causes a rise of 82mmHg in intraocular pressure. Although this much amount of pressure rise is well tolerated during refractive surgery, the elderly patients having cataract and coexisting glaucoma or other ocular comorbidity have an increased risk of retinal nerve fibre layer damage due to transient ischemia of the retinal tissues during the engagement process. An ideal interface would be one which stabilizes the globe without causing any distortion of the eye or an increase in intraocular pressure. The interface employing a liquid cushion between the eye and the laser system minimizes the above-mentioned complications and also prevents corneal folds that occur with suction ring. This allows for a precise laser focus, thus, minimizing the energy, reducing the cavitation bubble formation and optimizing the treatment results.

All the three systems i.e. the OptiMedica, the LenSx and the LensAR have proved to be effective in stabilizing the globe and minimizing the risk of intraocular pressure spikes during the surgery. However, the method and device for docking appears to be different for each laser platform. OptiMedica employs liquid optics interface which causes a pressure rise of only 8-12mmHg and has good stabilization of the globe during the engagement step. LenSx has a curved lens and suction system. LensAR has a non-contact, non-aplanating water-bath suction and fixation device.

C-The Visualization and Customization: The image guidance system is a critical part of femtosecond assisted cataract surgery as it determines the location and dimensions of the ocular structures i.e. the cornea, the iris and the crystalline lens capsule. This system allows the operating ophthalmologist to customize the zones for placement of laser assisted incisions and lens fragmentation. The corneal thickness should be determined so that the architecture of relaxing and surgical incisions can be properly customized for each patient. The system used must be able to detect the iris boundaries in order to safely direct the laser within even the asymmetrically dilated pupil. They must also generate a reference for the size and centration of the capsulorrhesis/capsulotomy. It is also critical to detect the posterior surface of crystalline lens in order to maintain a safety zone, preventing any inadvertent cuts in the posterior lens capsule.

The LenSx and the OptiMedica use Fourier-Domain Optical Coherence Tomography (FD-OCT) for three dimensional viewing of ocular structures. This allows for real-time, high resolution measurements of the corneal thickness, the lens position, the iris boundaries and the irido-corneal angle. The LensAR uses a three dimensional confocal illumination-scanning transmitter, a technology similar to Schiempflug camera system. Schiempflug camera systems are capable of determining corneal power elevation maps, the anterior chamber depth and the corneal wave-front analysis. The lens density can also be evaluated and quantified, allowing lens fragmentation settings to be selected automatically. A preview of the software for each system indicates that size of safety zones vary among each system to ensure that the laser energy does not adversely affect the ocular structures (Fig. 6).

D-The Treatment: This is the final step of the laser assisted cataract surgery. The laser spot pattern for a
single incision is applied from posterior to anterior. This maneuver maintains precise focus, avoiding scatter of the laser beam and also reduces the amount of radiations reaching the retina62.

The three systems differ in the order of incision delivery. The OptiMedica offers the capsulotomy/capsulorrhexis first and then the lens fragmentation. This sequence of events reduces the risk of a capsular tear or zonular dehiscence because the lens is allowed to relax as it is fragmented. In the LenSx system, initially the nucleus is fragmented and the capsulorrhexis is performed afterwards56.

**Clinical Outcomes of the Femtosecond Laser-Assisted Cataract Surgery:**

Nagy et al first published the results of cataract surgery using the LenSx femtosecond laser system in 2009. They compared the manual capsulorrhexis to laser assisted capsulorrhexis in porcine eyes on the basis of reproducibility and maximum resistance to stretching. Their results showed that the laser assisted capsulotomies were much more reproducible, uniform and precisely placed57. Scanning laser electron microscopy revealed that the edges of such capsulotomies were smooth and the strength of the rhexis edge could tolerate a higher stretching force before rupture. They also showed that the lens fragmentation via femtosecond laser led to a 43% reduction in phaco power and a 51% reduction in time. The corneal edema and the anterior chamber activity were mild in laser treated eyes during the first postoperative day and these findings resolved completely by first week post surgery57. Although the study employed only a limited number of patients, yet the femtosecond laser assisted cataract surgery appeared to be well tolerated for use in this study.

OptiMedica59,62 reported capsulotomy diameters within 27 microns (SD, 25microns) of the intended diameter (Fig. 5). This is compared with 183 microns (SD, 246microns) for LensAR60. LenSx reported that all capsulotomies were within 250microns of the intended diameter61. All the three companies found that the laser capsulotomies were more precise than manual capsulorrhexes with OptiMedica59 reporting manual results at 339microns (SD, 246microns), and the LensAR reporting nearly 500microns for manual capsulorrhexes60. For the capsulotomy, each company used different measurement techniques, a direct comparison of the three companies is not easily assessed.

For capsulotomy position, OptiMedica reported the intraocular lens centration within 86microns (SD, 51microns) of the intended placement60. The LenSx reported intraocular lens centration was significantly better (p=0.027) in laser assisted group61 as compared to the manual (Fig. 6). To date, LensAR has not reported on centration of the intraocular lens.

Studies are still underway to optimize the available patterns of lens fragmentation for each commercial system56,63. To assess the efficacy of laser assisted lens fragmentation, all the three companies looked at the ultrasound energy output of the phacoemulsification in lenses treated with laser or not and showed a marked reduction in ultrasound energy for all grades of cataracts. The percentage of energy reduction was variable among the three laser systems but was 33% at least62,63,64.

**Femtosecond Laser-Assisted Limbal Relaxing Incisions (iris):** Femtosecond laser systems can perform corneal or limbal relaxing incisions (LRIs) to correct up to 3.5 diopters of astigmatism. The laser causes flattening of the steeper meridian of the cornea thus eliminating the source of refractive error63. However at present, only a small number of patients are undergoing manual limbal relaxing incisions. This is because the manual incisions are technically demanding and have unpredictable results. Inconsistency in the outcomes of manual limbal relaxing incisions is often related to discrepancies in depth, axis, arc length and optic zone of the incision. It has been stated that an axis misalignment of just 5° results in 17% reduction in effect40. These problems have been solved by the advent of femtosecond lasers. The superior accuracy afforded by this laser over manual procedures could lead to an improvement in outcomes of limbal relaxing incisions.

**Femtosecond Laser-Assisted Clear Corneal Incisions (CCIS):** The self-sealing clear corneal incision is now the preferred method of entry into anterior chamber of the eye. Recent studies report that about 75% of the cataract surgeons in the USA are using the clear corneal incision during cataract surgery in an order to achieve a superior visual outcome and faster visual recovery41,42. The drawbacks of the manually created clear corneal incisions include an increased incidence of postoperative endophthalmitis13, gaping at the internal aspect of the wound and a risk of Descmet’s membrane detachment44. Femtosecond laser assisted clear corneal incisions show less features of damage and faster healing rate. This may be due to special properties of such wounds or from reduction in the mechanical stresses during the operation55,56.

**Femtosecond Laser-Assisted Penetrating Keratoplasty (PKP):** Earlier investigations involving femtosecond laser for penetrating keratoplasty incisions revealed that a “top-hat” shaped incision led to better wound stability with seven-fold increased resistance to leakage and a possible decrease in risk of postoperative astigmatism when compared to wounds created through conventional trephination72,73. In subsequent
Major Review of the Applications of Femtosecond Laser in Ophthalmology

studies on femtosecond laser assisted corneal incisions, a variety of other wound configurations were identified. These include the “mushroom”, the “zigzag” and the “Christmas tree” shapes (Fig. 7C-E). From a mechanical strength stand point, all of these wound configurations create more stable wound when compared to the traditional “butt” joint (Fig. 7A) created through standard corneal trephination. Optical distortion and poor visual outcome following penetrating keratoplasty are often a result of misalignment of the donor-host cornea, rotational misalignment, uneven suture tension and postoperative slow and uneven wound healing. The goal of femtosecond laser assisted corneal incision during penetrating keratoplasty is the creation of a structurally stable and predictable wound configuration with the objective of rapid visual rehabilitation and higher optical quality compared with conventional blade assisted trephination.

Earlier results of outcomes with the femtosecond laser assisted keratoplasty show better alignment of the donor-host surface. Improved sealing of the incision permits the ophthalmologist to use only optimal suture tension to keep the incision opposed without undue distortion of the cornea. In addition, increased surface area of these incisions leads to increased tensile strength of the wound, improving both patient safety and allowance of an earlier suture removal (Fig. 8). This in turn leads to a rapid visual recovery and lesser astigmatism than traditional blade assisted keratoplasty.

The first femtosecond laser platform to accomplish the full thickness cuts was the IntraLase (IntraLase Femtosecond Laser, Irvine, California, USA). With the use of this platform, penetrating keratoplasty is now better known as IntraLase Enabled Keratoplasty (IEK).

FEMTEC (20/10 perfect vision, Heidelberg, Germany) is the second platform by which stable full thickness keratoplasty can be performed. Preliminary studies performed on this system demonstrate that short time visual results of this system are analogous to other femtosecond assisted penetrating keratoplasty systems.

Price et al. through their study demonstrated that the endothelial cell loss at one year after femtosecond laser assisted keratoplasty was comparable to that in conventional keratoplasty. A rapid wound healing rate was observed in this study with mean time for suture removal of seven months. Hoffartet al. used the FEMTEC laser and showed that the visual and refractive outcome of this system was comparable to the other laser systems. It is also worth mentioning that the FEMTEC system currently allows only the straight cuts. Bahar et al. used the IntraLase system and showed that the visual outcome, wound healing rate and astigmatism control was superior with femtosecond laser assisted top-hat incision when compared to manual top-hat incision. Results of the studies conducted by Burrato and Bohm were also in line with findings of the above mentioned researchers.

Femtosecond assisted zigzag incision when compared to conventional trephination incision, had a more rapid visual recovery and less induced astigmatism. There was a significant difference in average astigmatism between the two groups at postoperative month 1 and 3 (3D in laser assisted incision versus 4.46D in conventional incision). Also, the number of patients achieving the visual acuity of 20/40 at three months was statistically higher (p≤0.03) in laser assisted group when compared to the manual trephination group (81% versus 45%).

The mechanism thought to be responsible for higher success rate of laser assisted incisions is the angled edge of the zigzag cuts, which provides a smooth anterior transition between the host-donor interfaces, leading to hermetic wound healing. This improved natural alignment intrinsically produces less optical distortion, watertight seal and less suture tension and resultant lesser amounts of astigmatism. Alternatively, there is rapid recovery of wound edema in femtosecond group due to less tissue manipulation and trauma as compared to conventional trephination.

The top-hat and the zigzag incisions are the two most popular femtosecond laser assisted incisions due to their enhanced accuracy over conventional incisions. For the same reason, from a biomechanical stand point, the zigzag cuts may prove to be the most stable. This type of incision allows for consistent suture placement at about 50% of stromal depth at the position where the posterior cuts and the lamellar incisions intersect. With top-hat incision, suture placement may vary leading to a possibility of posterior wound gape with a negative impact on postoperative visual outcome.

Recently, software has been developed allowing the application of radial alignment marks on the donor/host cornea. This helps more precise suture placement with an improved tissue distribution and a tendency towards lesser astigmatism in eyes undergoing femtosecond assisted keratoplasty. Another technique analogous to the radial alignment marks is the application of orientation teeth. This technique showed low-moderate astigmatism postoperatively.

Femtosecond Laser-Assisted Deep Anterior Lamellar Keratoplasty (Dalk): The femtosecond laser technology is recently being expanded to aid in other corneal transplantation techniques. Deep Anterior Lamellar Keratoplasty (DALK) with ‘big-bubble’ technique is now preferred procedure for anterior corneal disease. This technique has been employed
**Figure 1:** Laser capsulotomy.
View of an accurately sized and precisely shaped laser capsulotomy seen through the catalys™ precision laser system.

**Figure 2:** Intraocular lens as seen through the laser capsulotomy.
Slit-lamp view of a laser capsulotomy having uniform overlap of the intraocular lens optic.

**Figure 3:** One month postoperative.
Slit lamp view after one month of the manual (left) and laser-assisted (right) capsulorrhexis.

**Figure 4:** Laser-assisted lens fragmentation.
View of the laser-assisted lens fragmentation through the catalys™ precision laser system (left) and through the operating microscope (right).
successfully for treating the keratoconus as well as for the management of anterior stromal pathology in cases having a healthy endothelium. Anwar et al applied big-bubble technique for baring of descemet’s membrane during maximum depth anterior lamellar keratoplasty in patients having keratoconus. In a series of 181 eyes which underwent this procedure, 89% achieved visual acuity of 20/40 or better.

Big-bubble technique DALK has several advantages over conventional penetrating keratoplasty. These include the safety of extraocular procedure, low risk of endothelial rejection and a shorter course of postoperative corticosteroid use.

The big-bubble DALK technique described originally by Anwar et al requires a 60-80% trephination followed by intracameral injection of air and lamellar dissection of the anterior stroma manually in order to identify and reach the posterior stroma. Posterior stroma is then excised carefully over a blunt iris spatula in order to protect the Descmet’s membrane from the sharp tip. The newer technique employing femtosecond laser avoids the manual trephination and allows precise identification of tissue depth and injection of air by following a plane between the lamellar and posterior side cuts of the zigzag wound. Injection of a big-bubble at this depth facilitates full baring of the Descmet’s membrane.

The femtosecond DALK procedure has also been
Figure 8: Femtosecond laser assisted keratoplasty
Optical coherence tomography (OCT) of the cornea showing precision and uniformity of the femtosecond laser assisted corneal incisions.

used successfully using mushroom shaped incision\textsuperscript{94}. The reference radial incision marks created by the laser allow precise suturing of the tissue to optimize postoperative astigmatism and minimize the corneal distortion.

Penetrating keratoplasty for ectatic corneal conditions is traditionally known to have the most success rate in terms of visual recovery and healing. However, as these patients are usually younger, the risk of endothelial graft rejection is higher. The ideal procedure in such patients would be one that can maintain patient’s own endothelium and replaces only the diseased part of the stroma along with a superior wound approximation and minimal induced astigmatism. The femtosecond laser assisted custom shaped cuts combined with the big-bubble DALK technique successfully achieves this goal. This method also preserves the option to perform a full thickness penetrating keratoplasty with the benefits of femtosecond laser incision if the dissection of Descemet’s membrane fails during the surgery.

**Femtosecond Laser-Assisted Endothelial Keratoplasty (FLEK):** Use of femtosecond lasers for endothelial keratoplasty (FLEK) has yielded mixed results\textsuperscript{94,95}. Cheng et al performed a randomized controlled trial on a group of 80 eyes comparing femtosecond laser endothelial keratoplasty (FLEK) to conventional keratoplasty (PKP) and found that the patients undergoing femtosecond laser assisted surgery had a significantly lower postoperative astigmatism. At the same time it was also observed by the researchers that the best corrected visual acuity was significantly lower in group treated with laser assisted keratoplasty. This finding may be due to interface haze resulting from roughened collagen fibrils produced by the application of femtosecond laser. Additionally the femtosecond laser treated eyes had a greater incidence of endothelial cell loss when compared to the eyes undergoing conventional keratoplasty\textsuperscript{95}. Studies are ongoing to look at the energy level and the spot size patterns of the femtosecond laser in order to minimize interface haze and distortions. This may improve the results of the FLEK in near future.

**Future Prospects of Femtosecond Lasers in Ophthalmology:** Ultrasound Biomicroscopy (UBM) images of the normal accommodation in young eyes demonstrates that predominant effect on intact lens is at the level of the anterior capsule\textsuperscript{62}. Laser assisted cataract surgery, with its improved precision and accuracy, may allow a better preservation of the biomechanical properties of the lens capsule, enabling the creation of better accommodative intraocular lenses. Some studies are also investigating the femtosecond lasers to restore accommodation in presbyopic eyes by increasing the flexibility of the lens either by separating the collagen fibrils, or by applying the laser assisted incisions that act as gliding planes\textsuperscript{65-68}.

Other applications of the femtosecond lasers are being evaluated, expanding the patient population for which cataract surgery and lens exchange procedures are possible. Lee et al\textsuperscript{69} described a technique by which they created a flap to remove the corneal opacities, allowing better visualization of the cataractous lens and greater ease of maneuvering the difficult cases. Nishimoto et al\textsuperscript{70} describe using an intentionally decentered intraocular lens for managing the cases having vertical diplopia.

There are a group of investigators which is attempting to use the femtosecond laser to reverse some of the accumulated damages which lead to cataract and
presbyopia. Keesel et al have recently shown that the senile yellowing of the crystalline lens can be reduced by femtosecond laser assisted photolysis71.

CONCLUSION:
The future of the cataract surgery may be the treatment options that allow the lens to be extracted within a wholly intact capsule which could then be replaced with an injectable polymer. It may be that the natural crystalline lens can have its optical properties restored with femtosecond laser modifications. Throughout all these applications, the new femtosecond laser systems can emerge in the near future and bring the practicing ophthalmologist one step closer to an ideal surgery that corrects cataract, astigmatism and presbyopia all in single step.

REFERENCES:


Vitreous Cyst

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A 22 years old female presented with night blindness and reduced vision from early childhood presented with large object floating in front of left eye. BCVA, OD-6/24 OS-6/18. A small cyst clear fluid inside covered with pigments freely floating in mid vitreous. Regarding origin of congenital vitreous cysts, it is said that pigmented ones originate from pars ciliaris epithelium where as non-pigmented arise from hyloid vascular system.

DD: Cysticercosis, mobile pigmented vitreous cyst

Treatment options include argon laser or yagphotocystostomy for small and PPV for large cysts.
INTRODUCTION

Special attention to the pregnant women is one of the most important points in health care. One of the versal attention points of importance in pregnancy is the urinary tract infection (UTI).\(^1,2\) The prevalence of asymptomatic UTI has been reported to be 2% to 11% in pregnant women (6% to 8% in average).\(^3,7\) Due to the increase in sex hormones and the anatomic and physiologic changes during pregnancy, bladder and kidney infection is more likely and may result in hypertension, pre-eclampsia, low birth weight, prematurity, septicemia, and maternal death.\(^2,4,5,8,9\)

Risk of pre-term delivery or low birth weight babies and development of pyelonephritis decreased in the treatment group of asymptomatic bacteriuria compared with placebo or no treatment\(^10\). Routine screening for asymptomatic bacteriuria by midstream urine culture early in pregnancy is recommended as routine care for the healthy pregnant women by national collaborating center for women’s and children’s health in UK\(^11\).

Urinary tract infections (UTI) affects all age groups, but women particularly pregnant women are more susceptible than men, due to short urethra, pregnancy, easy contamination of urinary tract with fecal flora.\(^11\) UTI are a common problem in pregnancy. It is of two types, symptomatic or asymptomatic. Asymptomatic bacteriuria (ASB) is defined as the “presence of actively multiplying bacteria within the urinary tract excluding the distal urethra”, at a time when the patient has no urinary symptoms.\(^10\)

The most common infecting organism is escherichia coli, which is responsible for 75-90% of bacteriuria during pregnancy. 40% of the asymptomatic bacteriuria cases develop into acute symptomatic UTI. Hence early detection and treatment is of considerable importance not only to forestall acute pyelonephritis and chronic renal failure in the mother, but also to reduce prematurity and fetal mortality in the offspring.\(^12\)

MATERIAL AND METHOD

This descriptive study was conducted on women who attended outpatient department of Obstetrics & Gynecology of Hayatabad Medical Complex Peshawar from January’ 2012 to December’ 2012. The inclusion criteria set for this study was to include all pregnant women having no clinical features suggestive of urinary tract infection. Informed consent was taken from all the patients and
the requisite information were entered in the pre-designed proforma. Patients with the following features were not considered for this study.

**Exclusion criteria:**

i. Women with history of UTI Symptoms

ii. Women with medical problem like diabetes, hypertension or renal disease

iii. Women who had taken antibiotics in the last two weeks

iv. Women with active regional bleeding.

Urine samples were collected from the pregnant women qualifying the inclusion criteria in a tightly sealable sterile container. Microscopic examination of a wet film of un-centrifuged urine was carried out to detect the presence of pus cells, erythrocytes, microorganisms, casts etc. The samples were processed using standard microbiological procedures. Culture results were interpreted as being significant and insignificant, according to the standard criteria. The organism was identified by routine methods from the samples showing significant bacteriuria. The results were analyzed using mean, median and Chi-square test. P (predictive) value of <0.05 were considered as a significant association between the variables tested.

**RESULT**

The study revealed that according to the age distribution the highest number of culture positive cases (58%) among pregnant women were in the age group 25-35 years. 18 (23%) of the patients were in the age group of 18-24 years and 19% in the age group of 36-45 years.

<table>
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<th>Age Group</th>
<th>Total no. of Culture Positive Cases</th>
<th>%age in years</th>
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<tr>
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<td>19</td>
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<tr>
<td>Total</td>
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With respect to trimester the culture positive cases are as shown in Table 2.

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<td>Total</td>
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**DISCUSSION**

Asymptomatic bacteriuria is common during pregnancy. Relationship between the incidence of asymptomatic bacteriuria and pregnancy has always been a subject of interest. The frequency of ASB in my study was 10%. This figure falls within 2-10% range of prevalence in the population quoted in epidemiological studies.

In the present study, it is observed that pregnant women in the age group 25-35 years had highest percentage of infection (58%). Advanced maternal age was reported as risk factor for asymptomatic bacteriuria in pregnancy and also could be due to the fact that many women within this age group are likely to have had many children and it has been reported that multiparity is a risk factor for acquiring asymptomatic bacteriuria in pregnancy.

Most cases of asymptomatic bacteriuria were found during 3rd trimester (41%) of pregnancy. This results correlates with other studies. In our study significant growth was found in (10%) cases and (90%) samples were sterile. These results were consistent with reports of the recent studies. The presence of significant bacteriuria indicates the significance of microbiological culture to clinch the diagnosis of urinary tract infection. Bacterial isolates have been changing from time to time and from place to place. In our study organisms isolated, correlated with various others studies.

The antimicrobial sensitivity and resistance pattern varies from hospital to hospital. This is because of emergence of resistant strains as a result of unselective use of antibiotics. In our study isolates showed 100% sensitivity to imipenem. Among the aminoglycosides, amikacin demonstrated (85%) sensitivity. Nitrofurantoin (68%) showed increased sensitivity when compared to ceftazidime (62%) and cefotaxime (62%). Ampicillin was found to be least sensitive (11%). Our Anti-biogram pattern correlates with others studies. The upsurge in antibiotic resistant pattern could be due to antibiotic abuse and self-medication. Also low cost and availability of drugs could be another contributing factor for antibiotic resistance.

**CONCLUSION**

Asymptomatic bacteriuria is a common infection during pregnancy and may have adverse effects on mother and child, if left, undiagnosed. Routine urine cultural test should be carried out on all pregnant in order to identify any unsuspecting infection. There is need on the part of health care providers to realize the importance of screening pregnant women for ASB. This measure will help greatly in dropping maternal and
REFERENCES


