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<th>Other countries</th>
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# NEPALESE JOURNAL OF OPHTHALMOLOGY

Volume 5, No. 2, Issue 10 (July - December 2013)

## Contents

<table>
<thead>
<tr>
<th>Editorial</th>
<th>Page No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Editing the Nepalese Journal of Ophthalmology: a voyage of five years</td>
<td>143-144</td>
</tr>
<tr>
<td>Badhu BP, Khadel T</td>
<td></td>
</tr>
<tr>
<td>2. Ophthalmic oncology in Nepal – an area requiring special attention</td>
<td>145-146</td>
</tr>
<tr>
<td>Badhu BP</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Original articles</th>
<th>Page No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Correlation of progression of diabetic retinopathy with the alterations in retrobulbar circulation</td>
<td>147-153</td>
</tr>
<tr>
<td>Sood S, Narang S, Kocchhar S, Sarda S, Aggarwal S, Arya SK</td>
<td></td>
</tr>
<tr>
<td>2. Prospective comparison of chilled versus room temperature saline irrigation in alcohol-assisted photorefractive keratectomy</td>
<td>154-160</td>
</tr>
<tr>
<td>Neuffer MC, Khalifa YM, Moshirfar M, Mifflin MD</td>
<td></td>
</tr>
<tr>
<td>3. Computer vision syndrome: a study of knowledge and practices in university students</td>
<td>161-168</td>
</tr>
<tr>
<td>S C Reddy, C K Low, Y P Lim, L L Low, F Mardina, M P Nursaleha</td>
<td></td>
</tr>
<tr>
<td>4. Retinoblastoma: geographic distribution and presentation at a tertiary eye care centre in Kathmandu, Nepal</td>
<td>169-176</td>
</tr>
<tr>
<td>Saiju R, Moore G, Shrestha U, Shrestha MK, Ruit S</td>
<td></td>
</tr>
<tr>
<td>5. Successful treatment of lower eyelid epiblepharon by injection of botulinum toxin A in patients under two years of age</td>
<td>177-181</td>
</tr>
<tr>
<td>Chen CY, Nava-Castañeda A</td>
<td></td>
</tr>
<tr>
<td>6. Surgical outcomes of minimally invasive vitrectomy surgery in Eales’ disease</td>
<td>182-189</td>
</tr>
<tr>
<td>Sumeet Khanduja, Shikha Gupta, Subijay Sinha, Pradeep Venkatesh, Rajpal Vohra, Satpal Garg</td>
<td></td>
</tr>
<tr>
<td>7. Optical coherence tomography in diabetic macular edema: patterns and related risk factors</td>
<td>190-194</td>
</tr>
<tr>
<td>Mohammadreza Ahmadpour, Masoudreza Manaviat, Ahmad Shojaoddiny</td>
<td></td>
</tr>
<tr>
<td>8. A study on plasma homocysteine level in age-related macular degeneration</td>
<td>195-200</td>
</tr>
<tr>
<td>Ghosh S, Saha M, Das D</td>
<td></td>
</tr>
<tr>
<td>9. A comparative study of intraocular pressure measurement by three tonometers in normal subjects</td>
<td>201-206</td>
</tr>
<tr>
<td>Prabhakar SK, Mahesh BS, Shanthamallappa M</td>
<td></td>
</tr>
<tr>
<td>Bajracharya L, Gurung R, DeMarchis EH, Oliva M, Ruit S, Tabin G</td>
<td></td>
</tr>
<tr>
<td>11. Keratometric astigmatism evaluation after trabeculectomy</td>
<td>215-219</td>
</tr>
<tr>
<td>Kumari R, Saha B C, Puri L R</td>
<td></td>
</tr>
<tr>
<td>12. Comparison between limbal (von Noorden) and para limbal (Santiago) conjunctival incisions for adjustable recessions of horizontal recti</td>
<td>220-225</td>
</tr>
<tr>
<td>Agrawal S, Singh V, Gupta SK, Agrawal S</td>
<td></td>
</tr>
<tr>
<td>13. Prevalence and determinants of xerophthalmia in rural children of Uttarpradesh, India</td>
<td>226-229</td>
</tr>
<tr>
<td>Agrawal VK, Agrawal P, Dharmendra</td>
<td></td>
</tr>
</tbody>
</table>
14. Corneal edema after phacoemulsification surgery in patients with type II diabetes mellitus  
   Shakya K, Pokharel S, Karki KJD, Pradhananga C, Pokharel RP, Malla OK  
   230-234

15. Outcome of the patients with post-operative cluster endophthalmitis referred to a tertiary level eye care center in Nepal  
   Gautam P, Joshi SN, Sharma A, Thapa M, Shah DN, Sharma AK, Shah DN  
   235-241

Brief communication
1. Calcium carbide related ocular burn injuries during mango ripening season of West Bengal, eastern India  
   Bandyopadhyay S, Saha M, Biswas S, Ranjan A, Naskar AK, Bandyopadhyay L  
   242-245
2. Myopia in school children from high mountain region of Nepal  
   Adhikari S  
   246-249

Review article
1. Retinal functional imager (RFI): Non-invasive functional imaging of the retina  
   Ganekal S  
   250-257

Case reports
1. Ocular imaging findings of bilateral optic disc pit in a child  
   Ozkaya A, Alkin Z, Taylan AT, Demirok A  
   258-261
2. A rare case of a solitary intraocular neurofibroma  
   Chawla U, Khurana AK, Anand N, Jain P  
   262-264
3. Conjunctival Kaposi’s sarcoma as the initial manifestation of acquired immunodeficiency syndrome  
   Rodriguez CJ, Cordova JM  
   265-267
4. Impacted iron nail in the orbit and maxillary sinus through a corneo-scleral perforation: a case report  
   Kharel (Sitaula) R, Gautam V, KC Krishna, Shah D N  
   268-271
5. Traumatic avulsion and bilateral eye loss: report of two cases  
   Roka N, Roka YB, Acharya R  
   272-274
6. Recurrence of uveal malignant melanoma: a case report  
   Thapa M, Shrestha GB, Sharma AK, Karki S, Khanal S  
   275-278
7. Ocular myocysticercosis: an unusual case of ptosis  
   Agrawal S, Ranjan S, Mishra A  
   279-280
8. Central Retinal Arterial Occlusion (CRAO) after Phacoemulsification A Rare Complication  
   Lamichhane G, Gautam P,  
   281-283

Letters to editor
1. Conjunctival impression cytology  
   Sapkota K  
   284-285
2. Blepharoptosis and cysticercosis  
   Viroj Wiwanitkit  
   286
Until about five years ago, the ophthalmologists of Nepal had to struggle very hard to get their research findings published for dissemination among the members of the scientific community of the world. National data relating to the practice of ophthalmology and development of eye care were either not published or were limited to presentations in conferences or to publications in a local souvenir. The clinical experience of the growing number of Nepalese ophthalmologists could also not be shared with colleagues worldwide. This was, of course, grossly inadequate. But there was a long-cherished dream of launching a journal of ophthalmology in Nepal (Shah, 2009) so that the national scientists and researchers could have an arena for sharing their research findings at the international level. We were convinced that the scientific knowledge and experience had to be incorporated in practice (Ruit, 2009) for which publication of a journal was indispensible.

It was also thought that a peer-reviewed academic journal of ophthalmology of Nepal would be a contribution to further development of ophthalmic services in Nepal and of ophthalmology as a science.

Today, we can be happy that we have realized that dream. We can also take some pride in that the Nepalese Journal of Ophthalmology has been indexed in the pubmed and is listed in ‘HINARI’. The number of papers that the journal receives from Nepalese ophthalmologists is increasing every year. The journal has also been able to draw the attention of researchers at the international level.

The national and regional scientific conferences play a positive role in improving the scientific merit of the submitted articles because of the critical comments, interactions and the scientific deliberations. Periodic workshops on research methodology and scientific writings are useful for the practicing ophthalmologists and young researchers. The activities of the Nepal Ophthalmic Society in addressing these issues are highly appreciable.

Dreams, too, like computer programs need to be regularly ‘updated’. We now have to work harder to bring the scientific merit of the journal to a new height so that the citation index and the impact factor continue increasing. The impact factor of a journal increases if the papers published in the journal get cited by the other authors in other scientific journals.
The voyage of the five years of editing and publishing the journal of ophthalmology in Nepal has had its ups and downs, but, as a whole, was a challenging and educational opportunity.

However, we have been once in a while encountering some unacceptable behavior on the part of some potential authors of papers submitted to us. They are, particularly, plagiarism and duplicate submissions. These significantly disrupt the overall publication work, make it difficult to bring out the journal on time and present the Editorial Board with unnecessary frustrations. We are very much aware of these and have been making every effort to detect them by using the available software programs. But software programs are not omnipotent. We plead to the sense of honesty of all the authors to together develop our journal as the product of fully honest academic and scientific endeavors.

Some very good articles, material-wise, may not be accepted or be delayed in getting accepted if they are not linguistically satisfactory or do not strictly adhere to the prescribed house-style of the journal. We advise our potential authors to take this matter into account before submitting their work to the journal.

The authors should take the full responsibility for the articles submitted by them. We wish to receive manuscripts that are easy to read, easy to edit and that would draw the attention of the international scientific community.

We also take this opportunity to thank all of you who have helped in the job of the editorial board for these five years. Bringing out a journal, like most fruitful endeavors, is a team work. Let us all pledge to make the next five years in the life of our journal more robust than its first five years.

References


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Ophthalmic oncology in Nepal – an area requiring special attention
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The prevalence of blindness due to cataract, corneal diseases, glaucoma and the increasing incidence of diabetic retinopathy and age-related macular degeneration in a developing country like Nepal help to divert the attention of the eye care stakeholders away from the ophthalmic oncological conditions. The malignant tumors of the eyelid and conjunctiva and intra-ocular tumors like retinoblastoma and melanoma are diagnosed late in the course of the disease and the treatment outcomes generally are poor.

The widespread network of eye hospitals in Nepal does not take care of those sight, eye and life-threatening oncological conditions, nor do many of the eye doctors trained have special interest in this field of ophthalmology. This may be explained by the lack of appropriate treatment facilities in the various ophthalmic centers, the view of the ophthalmic managers that oncology is a non-priority area, the lack of trained and skilled personnel and the socio-economical hurdles. The same reasons might be applicable to the delayed presentation of the patients with these conditions.

In the eastern part of Nepal, we see many cases of basal cell and sebaceous gland carcinoma of the eye lids (Thakur et al, 2003; Lavaju et al, 2009) that require an extensive surgical excision. Retinoblastoma presenting with proptosis (Badhu et al, 2005) and malignant melanoma with metastasis is not unusual.

Marshal et al (2013) have recently reported that a hepatic MRI can detect metastasis of uveal melanoma before the onset of symptoms. However, they have not confirmed whether this has any role in the prolongation of the life of the patient.

An excellent outcome after primary enucleation of unilateral low-risk retinoblastoma has been reported by Aerts et al (2013). This may not be applicable most of the time in our circumstances due to the delayed presentation of the disease. An ophthalmic oncology center in a country like ours must be equipped with adjuvant chemotherapy and radiotherapy for a better outcome of the disease.

The current research on management of retinoblastoma is focused on inhibition of proto-oncogene spleen tyrisone kynase (SYK) to induce death of the retinoblastoma cells (Zhang et al, 2012). This novel treatment modality may offer a relief from the problem of retinoblastoma in the near future.

In the context of advancement in diagnostic technology and treatment modalities for malignancy of the eye and its adnexa, there seems to be a lot of scope for improving the overall management of ophthalmic oncological cases in a developing nation. Training opportunities for the
potential specialists, improving diagnostic and therapeutic equipment and incorporation of the technology in practice are the areas for improvement. Establishment of an oncological referral center in a region can be advised to address the issues related to the diagnosis and treatment of malignant conditions of the eye and its adnexa.

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Source of support: nil. Conflict of interest: none
Correlation of progression of diabetic retinopathy with the alterations in retrobulbar circulation

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²Departments of Radiology
Government Medical College & Hospital, Sector 32, Chandigarh, India

Abstract

Introduction: Color Doppler Imaging (CDI) is used widely to study retrobulbar circulation. Objectives: To determine the association between progression of diabetic retinopathy (DR) and alterations in retrobulbar arterial circulation using CDI studies. Materials and methods: Prospective observational case series. It is single institutional study of 50 eyes of nonproliferative diabetic retinopathy in 50 patients with type II diabetes mellitus. DR was graded according to ETDRS system. Retrobulbar circulation was studied in patients for Peak systolic velocity (PSV), End diastolic velocity (EDV) and Resistive index (RI) in Central retinal artery (CRA), Ophthalmic artery (OA) and Posterior ciliary artery (PCA) using CDI initially and reevaluated after 6 months or later for any change in retinopathy grade and arterial circulation parameters. The patients were grouped as Group I not showing progression of DR and Group II showing progression. The two groups were compared for any significant change in CDI parameters. Results: The baseline resistive indices were higher than normal population. There was significant increase in RI in PCA and CRA in all patients after 6 months. 14 patients (28%) showed progression of DR and 36 (72%) did not show progression of DR. There was no significant association with progression of retinopathy and CDI findings. (p=>0.05). Conclusion: The retrobulbar arterial circulation seems to be affected in all diabetics with DR. The changes appear to be progressive. The CDI findings in arterial circulation however lack predictive power for progression of diabetic retinopathy in non proliferative DR.

Keywords: Retrobulbar arterial circulation, diabetic retinopathy, Color Doppler imaging

Introduction

Ever since the introduction of Doppler ultrasound in evaluation of retrobulbar circulation (Erickson et al, 1989), it has been used widely to study various ophthalmologic disorders. Color Doppler imaging is a noninvasive method to detect the flow of blood in retrobulbar blood vessels with good reliability and reproducibility (Williamson et al, 1994; Matthiessen, 2004). It has been used to study diabetic retinopathy (Göbel et al, 1995; Güven,1996). Many clinical aspects of diabetes mellitus have been studied using CDI such as proliferative diabetic retinopathy, effect of pan retinal photocoagulation in proliferative diabetic retinopathy (Mendivil et al, 1995a, 1995b,1996,1997,1998), choroidal circulation in diabetics (Dimitrova et al, 2001), progression to proliferative diabetic retinopathy (Dimitrova et al, 2003; Tomaz Gracner, 2004), type 1 diabetic children and adolescent without diabetic retinopathy (Gulgun et al, 2008), type 1...
diabetic retinopathy and dyslipidemia (Modrzejewska et al, 2008). The present study was carried out to study the correlation of changes in retrobulbar circulation with progression of non-proliferative diabetic retinopathy in patients with type II diabetes mellitus.

**Material and methods**

This was a prospective study of 50 eyes of 50 patients with type II diabetes mellitus of more than 5 years duration. The study was approved by the institutional review board. Initially, data from both the eyes of each patient was recorded. At the final follow up of 6 months only one eye of each patient was included. In the case of a patient showing progression of DR, the eye with progression was included in the study. Any increase in grade of diabetic retinopathy from previous evaluation was considered as progression. In cases where progression was bilateral and in the non-progression group, data from the right eye was included in the analysis, unless that eye had been subjected to laser photocoagulation or any surgery in the past.

We excluded eyes with metabolically unstable diabetes, diagnosed cases of glaucoma, myopia > 6 diopters, history of intra ocular surgery or ocular trauma within preceding three months, eyes without diabetic retinopathy or having proliferative diabetic retinopathy, and with significant media opacities precluding fundus photography. Proliferative diabetic retinopathy cases were not included as further progression in these cases was difficult to comment. A detailed history was taken. All patients were subjected to baseline systemic investigations which included - fasting blood sugar (FBS), post prandial blood sugar (PPBS), glycosylated blood sugars (HbA1c), lipid profile, 24 hour urinary proteins, blood urea and serum creatinine, blood pressure and ECG to confirm metabolic control. The patients were subjected to detailed stereoscopic ocular examination with slitlamp and +90D and +20D lens. Intraocular pressure was recorded with Goldmannapplanation tonometer. Fundus photography in 7 fields of Airlie House classification (DRS report No 7, 1981) was done for all patients using Zeiss Retinal Digital Imaging system. Baseline fundus fluorescein angiography was carried out for all patients. On the basis of their fundus photographs, the diabetic retinopathy was graded into mild, moderate, severe and very severe NPDR according to ETDRS system (ETDRS report no 12, 1991) using standard photographs 2A and 8A at the time of enrollment.

All patients were subjected to Color Doppler Imaging using 5 - 7.5 MHz transducer on Hewlett Packard (Image Point) Imaging System. It was performed with the patient lying supine, eyes closed and gaze directed upwards and the Color Doppler probe applied with contact jelly through the closed upper lid. Three consecutive readings were taken to avoid any effect of the respiratory cycle upon the velocities. Arteries that were imaged include the central retinal artery, posterior ciliary artery and ophthalmic artery. The parameters that were studied were peak systolic velocity (PSV), end diastolic velocity (EDV), resistive index (RI). PSV and EDV are obtained from the fastest velocities in systole and diastole respectively. Resistive index (PSV-EDV/PSV) is usually quoted from 0 to 100% (or 0 to 1) with 0 representing no resistance and 100 representing highest resistance.

All patients were seen at 3 months, 6 months and 3 monthly thereafter with a minimum of 6 months follow up. At each visit, a detailed clinical examination, fundus photography, fundus fluorescein angiography and color Doppler imaging were done. The grading of DR, and color Doppler parameters of last visit were considered to look for progression of diabetic retinopathy.

For the purpose of statistical analysis, eyes were retrospectively grouped into Group I (eyes not showing progression of DR) and Group II (eyes showing progression of DR).

**Results**

The study included 28 (56%) males and 22 (44%) females. The age of patients ranged from
38 to 75 years (mean age 55.8 ± 8.4 years). The duration of diabetes ranged from 6 years to 25 years (mean 12.9 ± 5.5 years). Twelve patients (44%) were on insulin treatment and 38 (76%) were on oral hypoglycemic agents (OHA’s) only for control of their diabetes. None of the patients were on diet control. Systemic parameters were well controlled throughout the study period for all. At the initial visit, 27 patients (54%) were graded to have mild non-proliferative diabetic retinopathy (NPDR) and 23 (46%) to have moderate NPDR and none of patients had severe NPDR. Of these patients, 14 (28%) had clinically significant macular edema (CSME) for whom modified grid laser treatment was done. The follow up period ranged from 6 months to 2 years (mean follow up period being 12.20 ± 3.2 months). The mean values of retrobulbar circulatory parameters at the initial visit and last follow-up visit are given in Table 1.

Table 1: Mean color doppler index parameters of patients at initial and final visit

<table>
<thead>
<tr>
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<th>Peak systolic velocity (cm/s)</th>
<th>End diastolic velocity (cm/s)</th>
<th>Resistive index</th>
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<td>Initial Final</td>
<td>Initial Final</td>
<td>Initial Final</td>
</tr>
<tr>
<td>Ophthalmic artery</td>
<td>33.42 ± 18.02 36.97 ± 13.47</td>
<td>9.12 ± 4.93 8.09 ± 3.69</td>
<td>0.75 ± 0.07 0.76 ± 0.08</td>
</tr>
<tr>
<td>Central retinal artery</td>
<td>14.28 ± 11.21 17.72 ± 7.57</td>
<td>5.64 ± 3.81 4.29 ± 2.71</td>
<td>0.67 ± 0.10 0.78 ± 0.10</td>
</tr>
<tr>
<td>Posterior ciliary artery</td>
<td>15.36 ± 7.17 20.71 ± 11.68</td>
<td>3.44 ± 1.88 4.62 ± 2.85</td>
<td>0.65 ± 0.14 0.76 ± 0.12</td>
</tr>
</tbody>
</table>

Figures 1a to 1c show the CDI parameters at the initial visit (Figure 1).

![Figure 1 a](image1a)

![Figure 1 b](image1b)

![Figure 1 c](image1c)

The final visit CDI parameters are reflected in figures 2a to 2c (Figure 2).
When the patients were assessed at the final visit, 36 patients (72%) showed no progression in the status of their diabetic retinopathy (Group I) and 14 patients (28%) showed progression (Group II). Of the initial 27 patients having mild NPDR, only 19 (70.37%) remained as mild NPDR, 4 (14.8%) progressed to moderate NPDR, 2 (7.4%) to severe NPDR, 2 (7.4%) to PDR at last follow up. Of the initial 23 patients having moderate NPDR, 17 (73.91%) continued to have moderate NPDR, 2 (8.69%) progressed to severe NPDR, 4 (17.39%) to PDR. The groups were comparable for age, duration, type of treatment, associated systemic diseases like hypertension and nephropathy. All patients were metabolically stable diabetics and progression of disease could not be attributed to hypertension, heart or kidney problems. The mean duration of diabetes was comparable in the two groups, 12.56 ± 5.10 years and 13.86 ± 6.62 years in groups I and II respectively.

Both the groups had statistically comparable values at the final follow-up in the inter-group analysis (p > 0.05) (Table 2).

### Table 2: Inter group comparison of retrobulbar circulatory parameters at baseline and last follow up visit

<table>
<thead>
<tr>
<th>Baseline retrobulbar circulatory parameters</th>
<th>Group 1 (no progression in diabetic retinopathy)</th>
<th>Group 2 (progression in diabetic retinopathy)</th>
<th>P value (p &lt; 0.05)</th>
</tr>
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<tr>
<td><strong>OA1</strong>&lt;br&gt;PSV</td>
<td>33.95 ± 16.75 cm/s</td>
<td>32.31 ± 21.60 cm/s</td>
<td>0.78</td>
</tr>
<tr>
<td>EDV</td>
<td>10.08 ± 5.74 cm/s</td>
<td>7.18 ± 1.76 cm/s</td>
<td>0.21</td>
</tr>
<tr>
<td>RI</td>
<td>0.74 ± 0.08</td>
<td>0.77 ± 0.07</td>
<td>0.21</td>
</tr>
<tr>
<td><strong>CRA1</strong>&lt;br&gt;PSV</td>
<td>14.65 ± 12.39 cm/s</td>
<td>13.32 ± 7.67 cm/s</td>
<td>0.71</td>
</tr>
<tr>
<td>EDV</td>
<td>5.84 ± 4.16 cm/s</td>
<td>5.21 ± 3.18 cm/s</td>
<td>0.73</td>
</tr>
<tr>
<td>RI</td>
<td>0.67 ± 0.10</td>
<td>0.70 ± 0.10</td>
<td>0.36</td>
</tr>
<tr>
<td><strong>PCA1</strong>&lt;br&gt;PSV</td>
<td>14.78 ± 6.66 cm/s</td>
<td>16.84 ± 8.45 cm/s</td>
<td>0.37</td>
</tr>
<tr>
<td>EDV</td>
<td>3.11 ± 1.71 cm/s</td>
<td>4.16 ± 2.16 cm/s</td>
<td>0.23</td>
</tr>
<tr>
<td>RI</td>
<td>0.65 ± 0.12</td>
<td>0.64 ± 0.18</td>
<td>0.80</td>
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<table>
<thead>
<tr>
<th>At last follow up visit</th>
<th>Group 1 (no progression in diabetic retinopathy)</th>
<th>Group 2 (progression in diabetic retinopathy)</th>
<th>P value (p &lt; 0.05)</th>
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<tr>
<td><strong>OA2</strong>&lt;br&gt;PSV</td>
<td>36.15 ± 13.53 cm/s</td>
<td>39.10 ± 13.57 cm/s</td>
<td>0.49</td>
</tr>
<tr>
<td>EDV</td>
<td>8.38 ± 4.00 cm/s</td>
<td>7.24 ± 2.54 cm/s</td>
<td>0.36</td>
</tr>
<tr>
<td>RI</td>
<td>0.76 ± 0.07</td>
<td>0.77 ± 0.09</td>
<td>0.50</td>
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<tr>
<td><strong>CRA2</strong>&lt;br&gt;PSV</td>
<td>18.16 ± 7.84 cm/s</td>
<td>16.60 ± 6.98 cm/s</td>
<td>0.51</td>
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<td>EDV</td>
<td>4.40 ± 2.57 cm/s</td>
<td>3.98 ± 3.20 cm/s</td>
<td>0.65</td>
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<tr>
<td>RI</td>
<td>0.76 ± 0.10</td>
<td>0.82 ± 0.13</td>
<td>0.11</td>
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<td><strong>PCA2</strong>&lt;br&gt;PSV</td>
<td>22.53 ± 11.99 cm/s</td>
<td>16.03 ± 9.72 cm/s</td>
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<td>EDV</td>
<td>5.08 ± 3.06 cm/s</td>
<td>3.22 ± 1.49 cm/s</td>
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<tr>
<td>RI</td>
<td>0.75 ± 0.09</td>
<td>0.08 ± 0.16</td>
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</tbody>
</table>

OA - Ophthalmic artery, CRA - Central retinal artery, PCA - Posterior cilliary artery, PSV - Peak systolic velocity, EDV - End diastolic velocity, RI - Resistive index
However, in the intra-group analysis when the last color Doppler measurement was compared with first readings, both the groups had a significant increase in the resistive index in CRA and PCA with increasing duration of diabetes (Table 3).

Discussion

Diabetic retinopathy is a potentially blinding disease and remains an important public health problem. There is limited literature available regarding changes in retrobulbar circulation. The present study was carried out to ascertain the predictive role of retrobulbar arterial circulation in the progression of NPDR in NIDDM patients.

In the present study, RI in CRA and PCA increased significantly in all the NIDDM eyes with diabetic retinopathy as duration of disease increased despite adequate metabolic control. However, no correlation was found between diabetic retinopathy progression and alteration of retrobulbar arterial circulation during this follow-up. The RI is a measure of blood flow and it is inversely proportional to the blood flow. RI in various arteries seemed to increase over a period of time in all diabetic patients. These results demonstrate that all diabetic patients with retinopathy suffer from increased blood flow resistance in the major vessels feeding the eye. However, certain other factors contribute to the development of proliferative disease or progression of diabetic retinopathy.

Konno et al (1996) conducted a study on IDDM patients using Laser Doppler flowmetry and monochromatic photography. They took measurements of temporal retinal artery and found that as the duration of diabetes increases and as the disease become more severe, there is a transition from negative to positive retinal blood flow slopes. They found that blood speeds

Table 3: Intra group comparison of retrobulbar circulatory parameters during first and last visit

<table>
<thead>
<tr>
<th></th>
<th>1st measurement</th>
<th>Last measurement</th>
<th>P-value (p&lt;0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OA1-OA2</td>
<td>PSV 32.31 ± 21.61 cm/s</td>
<td>39.10 ± 13.57 cm/s</td>
<td>0.18</td>
</tr>
<tr>
<td></td>
<td>EDV 7.65 ± 1.91 cm/s</td>
<td>7.09 ± 2.23 cm/s</td>
<td>0.69</td>
</tr>
<tr>
<td></td>
<td>RI 0.77 ± 0.08</td>
<td>0.77 ± 0.93</td>
<td>0.97</td>
</tr>
<tr>
<td>CRA1-CRA2</td>
<td>PSV 13.32 ± 7.67 cm/s</td>
<td>16.60 ± 6.98 cm/s</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>EDV 5.52 ± 3.84 cm/s</td>
<td>5.62 ± 2.71 cm/s</td>
<td>0.96</td>
</tr>
<tr>
<td></td>
<td>RI 0.70 ± 0.10</td>
<td>0.82 ± 0.13</td>
<td>0.008</td>
</tr>
<tr>
<td>PCA1-PCA2</td>
<td>PSV 16.84 ± 8.45 cm/s</td>
<td>16.03 ± 9.72 cm/s</td>
<td>0.84</td>
</tr>
<tr>
<td></td>
<td>EDV 5.01 ± 1.87 cm/s</td>
<td>3.20 ± 0.97 cm/s</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>RI 0.64 ± 0.18</td>
<td>0.80 ± 0.16</td>
<td>0.02</td>
</tr>
</tbody>
</table>

OA - Ophthalmic artery, CRA - Central retinal artery, PCA - Posterior ciliary artery, PSV - Peak systolic velocity, EDV - End diastolic velocity, RI - Resistive index

However, in the intra-group analysis when the last color Doppler measurement was compared with first readings, both the groups had a significant increase in the resistive index in CRA and PCA with increasing duration of diabetes (Table 3).
in the retinal arteries of patients with IDDM are significantly lower than normal. They further observed that the arterial blood speeds were already low before clinical appearance of retinopathy.

Dimitrova et al (2001) studied choroidal circulation in diabetic patients and found that not only the retina but also the choroidal circulation is affected in diabetics. They found posterior ciliary artery circulatory alterations in NDR (no diabetic retinopathy) and BDR (background diabetic retinopathy) patients suggesting choroidal circulatory dysfunction. The increased posterior ciliary artery resistive index (RI) in NDR patients suggested reduced vessel wall compliance in the choroid that is present in all diabetics irrespective of the presence of DR. A similar pattern of circulatory changes was detected in all the three measured arteries (central retinal, posterior ciliary, and ophthalmic artery) comprising decreased EDV and increased RI in BDR patients, which indicates an increase in ocular peripheral vascular resistivity. In the present study, only NIDDM patients with non-proliferative diabetic retinopathy were included and decreased vessel wall compliance and increased resistivity was seen in CRA and PCA. However, OA did not show any significant difference from normal population. These changes increased over the period of follow-up. Thus, the changes in retrobulbar circulation of PCA and CRA could have bearing on the development of diabetic retinopathy.

Dimitrova et al (2003) studied longitudinally the changes in retrobulbar circulation with progression of diabetic retinopathy. They found that with progression of DR, there was a significant increase in PSV, EDV and RI in the central retinal vein but not in the central retinal artery and posterior ciliary artery. They concluded that the initial changes in the retrobulbar circulation during DR progression occur in the central retinal vein only and the arterial retrobulbar circulation does not seem to guide the progression of DR. In our study also, changes in retrobulbar arterial circulation do not seem to guide the progression, as the changes were present in both progressive and non-progressive groups.

Tomaz Grachner (2004) found a significant increase in the resistive index in the posterior ciliary artery in the PDR group as compared to NPDR and healthy controls. In our study, PDR patients were excluded from the study and a significant increase in the resistive index in both the posterior ciliary artery and the central retinal artery was seen in all diabetic patients whether the retinopathy progressed or not.

Gulgun YO et al (2008) found a significant increase in the resistive index in the posterior ciliary arteries and a significant decrease in RI in ophthalmic artery in young patients with type 1 DM without diabetic retinopathy as compared to healthy controls. RI in these arteries appears to be a function of the duration of diabetes mellitus and short term changes are not associated with progression of diabetic retinopathy. But the relation of this irregularity to disease progression requires extensive research. Thus, the arterial circulation in diabetes is less compliant and has a higher RI.

There have been some lacunae in the present study relating to the small sample size that was evaluated and the short duration of follow-up. The follow up period in the present study might not have been long enough for the clinically apparent progression of DR. It may be probably more useful to conduct a prospective study involving a large number of patients with a longer follow-up and compare values within individual patients over time and then make comparisons between the best and worst quartiles in terms of retinopathy grades.

**Conclusion**

In the present study, alterations in the retrobulbar arterial circulation do not seem to predict the progression of diabetic retinopathy and development of proliferative disease in NIDDM patients. The retrobulbar arterial circulation appeared to be affected in all diabetics and the changes appear to progress with increasing duration in all diabetics. However, apart from the vascular supply, certain other factors seem to play a role in progression of diabetic retinopathy.
References


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Prospective comparison of chilled versus room temperature saline irrigation in alcohol-assisted photorefractive keratectomy

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Abstract

Introduction: Chilled saline is commonly used to irrigate the ocular surface after photorefractive keratectomy (PRK) and is often considered by the patients to be uncomfortable. Room temperature (non-chilled) saline may be a safe and less painful alternative. Objectives: To compare pain and visual outcomes after irrigating the ocular surface with chilled saline versus room temperature saline in alcohol assisted PRK. Materials and methods: In this prospective, single-masked, randomized, contralateral eye study, myopic eyes were treated with PRK. Immediately after laser ablation one eye was irrigated with chilled saline and the other with non-chilled saline. Primary outcomes measured were pain, haze, uncorrected (UCVA) and best-corrected (BCVA) visual acuities, and manifest refraction. Results: Each group comprised of 40 eyes. There was no significant difference in pain between the groups at any point during five days after surgery. At 6 months the mean UCVA was -0.08 logMAR ± .077 [SD] (20/17) and -0.07 ± .074 logMAR (20/17) in the chilled and non-chilled groups respectively (p = .35). Both groups achieved 95% UCVA of 20/20 or better. The manifest refraction spherical equivalent (MRSE) was -0.05 ± 0.21 D and -0.025 ± 0.27 D respectively (p = .79). There were no lines lost of BCVA and no haze observed. Similar outcomes were observed with regard to pain and vision in both groups. Conclusion: The use of room temperature saline irrigation during PRK appears to be safe and effective.

Keywords: photorefractive keratectomy, PRK, chilled saline, balanced salt solution, refractive surgery

Introduction

Chilled saline is commonly used to irrigate the ocular surface immediately after photorefractive keratectomy (PRK). This type of treatment, referred to as cold therapy, has been used to treat pain and swelling in musculoskeletal injuries for generations (Ernst & Fialka, 1994). Several studies suggest the use of chilled saline during PRK helps limit postoperative pain and prevent haze (Kitazawa et al 1999; Nizuma et al 1994; Stein et al 1999; Tsubota et al 1993); however, these early studies were performed using older-generation excimer lasers and surgical techniques. Since the mid-1990s, advances in laser technology and surface ablation techniques including the use of topical NSAIDs (Caldwell & Reilly, 2008), better bandage contact lenses (Cherry et al 1994; Edwards et al
2008; Engle et al 2005), prophylactic mitomycin C (Carones et al 2002), and systemic vitamin C (Stojanovic et al 2003) have significantly reduced postoperative pain and haze (Trattler & Barnes, 2008). The process of irrigating the ocular surface with chilled saline may be uncomfortable or even painful for the patient, and no modern studies have supported the necessity of this step as part of the PRK procedure. Our working hypothesis proposes that the use of chilled saline irrigation may be unnecessary given the technological advances of modern PRK. This prospective, single-masked, randomized, contralateral eye study compares outcomes of irrigating the ocular surface with chilled saline versus room temperature (non-chilled) saline in PRK.

Materials and methods
An Institutional Review Board approved the study and written consent was obtained from each patient. All patients included met the Food and Drug Administration guidelines for VISX CustomVue™ (Advanced Medical Optics, Santa Ana, CA) laser surgery. Patients with clinically significant lens opacities, previous corneal or intraocular surgery, keratoconus, unstable refraction, autoimmune disease, pregnancy or breastfeeding, or immunosuppressive therapy were excluded. Contact lenses were discontinued for at least one week for soft and for six weeks for rigid, gas-permeable lenses prior to screening. All patients had preoperative assessments including uncorrected visual acuity, best-corrected visual acuity, tonometry, slit lamp and dilated fundus examinations. Corneal topography and thickness were measured using the Pentacam LC topographer (OCULUS, Wetzlar, Germany). All eyes received at least five preoperative wavefront analyses with the VISX WaveScan™ aberrometer (Fourier Advanced Medical Optics, Santa Ana, CA). Contrast sensitivity was measured in controlled mesopic conditions at 3, 6, 12, and 18 cycles per degree using the Vectorvision CSV-1000E chart (Vectorvision, Greenville, Ohio).

The dominant eye of each enrolled patient was randomly assigned to either the chilled or non-chilled saline group, with the fellow eye receiving alternate treatment. PRK was performed in the following manner. Patients received two drops of topical tetracaine 3-5 minutes before the procedure and two additional drops just prior to insertion of the eyelid speculum. No systemic sedation was utilized preoperatively or intraoperatively. The pericocular region was prepped with 5% povidone iodine swabs and the lashes were draped with sterile adhesive plastic. The right eye was treated first and the left eye second for all patients, regardless of randomization. An adjustable eyelid speculum was placed and an 8 mm well was positioned on the epithelial surface centered over the pupil. A 20% ethanol solution was instilled and remained in contact for 30-40 seconds, followed by rinsing and then gentle debridement with a spatula. Laser ablation was carried out using Fourier v.5.10 software on the VISX Star S4 CustomVue™ laser creating a 6.5 mm optical zone and 8.00 mm transition zone. Mitomycin C was not used at any time during the study. Immediately after ablation, the ocular surfaces were cooled with 15 ml of either chilled (2.8 – 3.9 C) Balanced Salt Solution (BSS® Alcon Laboratories, Inc, Fort Worth, TX) or non-chilled (16 – 20 C) BSS over a period of 30-40 seconds. This was followed by one drop of gatifloxacin 0.4%, prednisolone acetate 1%, ketorolac tromethamine 0.4% and a bandage soft contact lens. Ketonolac tromethamine was continued 2 times a day for 3 days and then discontinued. Gatifloxacin and prednisolone acetate were continued four times a day for 1 week. Bandage contact lenses were removed once re-epithelialization was complete, typically on post-operative day four or five. Prednisolone acetate was continued twice a day until the one month visit and then the patients were switched to a weaker steroid to be used two times a day for month two, and once daily for post operative month three. All patients were instructed to use preservative-free artificial tears at least four
times per day for the duration of the study. All patients were prescribed hydrocodone/acetaminophen tablets to use as needed for severe pain.

All surgeries were performed in the morning. After surgery, patients were asked which eye was more uncomfortable during BSS irrigation. Patients then recorded subjective pain for each eye using the Ocular Pain Scale log every 12 hours for the first five days after surgery. The log consisted of numbers 0 – 10 with zero being “no pain” written at one end and ten being “worst pain imaginable” at the other. At each assessment period, patients were asked to circle the number that best represented the severity of pain they were experiencing. In addition, patients were interviewed concerning their use of oral pain medication during the first 3 days after surgery.

Corneal sub-epithelial haze was graded using the Fantes scale: grade 0 = clear; grade 0.5 = trace opacity only seen by indirect broad illumination; grade 1 = minimal density seen with difficulty with direct and diffuse illumination; grade 2 = mild haze visible with direct focal slit illumination; grade 3 = moderately dense opacity that partially obscures iris detail; and grade 4 = severely dense opacity that obscures intraocular structures (Fantes et al 1990).

Uncorrected visual acuity (UCVA), loss or gain of best-corrected visual acuity (BVCA), manifest refraction, higher order aberrations and contrast sensitivity were compared for each group. Visual outcome statistics were compiled for three and six-month postoperative visits. Wilcoxon signed rank tests were used to analyze ordinal data (e.g. pain and haze), and student t-tests were used for numerical data.

**Results**

Eighty-eight eyes of 44 patients were initially enrolled in the study, with 44 eyes enrolled in the chilled group and 44 eyes in the non-chilled group. 23 eyes were right eye dominant and 21 left eye dominant. The mean age was 31.8 years (range 22 to 46) with 68.8% men and 31.2% women. The mean pre-operative spherical equivalent was -3.42 D (-0.25 to -6.25) in the chilled group and -3.43 D (-0.50 to -7.13) in the non-chilled group. There was no statistically significant difference in any preoperative characteristics between the two groups including amount of myopia and/or astigmatism, higher order aberrations and contrast sensitivity performance. Four patients discontinued the study due to noncompliance or relocation. Data were collected on 80 eyes of 40 patients.

**Pain**

Both groups reported a significant increase in pain (chilled \( p = .008 \); non-chilled \( p = .003 \)) from the time of surgery (0 hours) to 36 hours after surgery, with a gradual diminution over the next 36-48 hours (Fig. 1). There was no significant difference in pain between the chilled and non-chilled group at any point during the first five days after surgery, and most patients reported mild to moderate pain over the recording period. Although there was a trend for the chilled group to rate the irrigation step as more uncomfortable (mean 2.95 ± 0.78) at the time of surgery than the non-chilled group (mean 2.48 ± 0.64), this did not reach statistical significance \( (p = .08) \). Further sub-classification of pain into mild, moderate and severe did not reveal any statistically significant differences, although the chilled group had a trend toward more pain at the time of surgery (Figure 2).

Oral pain medication usage varied with most patients using hydrocodone/acetaminophen tablets, generally less than five doses, starting the day of surgery. Seven patients only used ibuprofen tablets and four patients did not use any oral pain medication (Table 1).

**Haze**

Two eyes in the chilled group had observable haze (one grade 0.5, and one grade 1) at 3 months. Neither eye had loss of BCVA or contrast sensitivity. These patients received no intervention for haze other than continued use of artificial tears, and steroid drops were tapered or discontinued per the study protocol. No haze was recorded in the non-chilled group at three months postoperatively. No haze
was found in either group at the six-month postoperative visit, including in the two eyes in the chilled group that previously had haze.

Visual acuity and refraction
The average UCVA at postoperative month six was 20/17 (logMAR -0.08 ± 0.077) in the chilled group and 20/17 (logMAR -0.07 ± 0.074) in the non-chilled group (Table 2). Thirty-eight (95%) eyes in each group achieved an UCVA of 20/20 or better and 40 (100%) eyes in each group achieved an UCVA of 20/25 or better. Neither group lost any lines of BCVA. Seven eyes in the chilled group and five eyes in the non-chilled group gained ≥ 1 line of BCVA, but there was no significant difference (p = 0.43) between the groups. The manifest refraction spherical equivalent (MRSE) at six months was -0.05 ± 0.21 D in the chilled group and -0.025 ± 0.27 D in the non-chilled group (p = 0.79).

Secondary outcomes
Total higher order aberrations root mean square (HOA rms) with a ≥ 6 mm pupil was measured with the VISX WaveScan™ aberrometer. No difference was found in the total HOA rms values between the two groups preoperatively (p = 0.86), at three-months (p = 0.53), or at six-months (p = 0.77) (Fig. 3). As expected, total HOA increased from preoperative to six-month measurements but the difference was not statistically significant (chilled p = 0.15, non-chilled p = 0.09). Contrast sensitivity using the Vectorvision CSV-1000E chart also demonstrated no significant difference between the two groups preoperatively (p = 0.95), at three-months (p = 0.64), or at six-months (p = 0.36).

High myopia
Ten (five eyes in each group) of the 80 eyes had a preoperative MRSE > - 6.00 D. Analysis of the group demonstrated no significant difference in outcomes from the eyes with low to moderate myopia. The high myopia group had no haze or lines lost of BCVA at six months. The six-month UCVA (chilled 20/17, non chilled 20/19, p = 0.24) and MRSE (chilled +0.10 ± 0.37, non-chilled +0.15 ± 0.57, p = 0.86) were also not significantly different between the chilled and non-chilled groups and from the eyes with low to moderate myopia.
Table 1: Number of patients using pain kills

<table>
<thead>
<tr>
<th>Number of Narcotic Tablets (e.g. oxycodone/acetaminophen, hydrocodone/acetaminophen)</th>
<th>First Day to Use Pain Pills</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5 tablets</td>
<td>12</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>5 - 10 tablets</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>10 - 15 tablets</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Ibuprofen only (&lt; 5 tablets)</td>
<td>6</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

No pain medications = 4 patients

Table 2: Six-months post operative data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Chilled (n=40)</th>
<th>Non chilled (n=40)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE refraction (D)</td>
<td>Mean ± SD</td>
<td>-0.05 ± 0.21</td>
<td>-0.025 ± 0.27</td>
</tr>
<tr>
<td>Range</td>
<td>-0.50 to +0.38</td>
<td>-0.75 to +0.88</td>
<td></td>
</tr>
<tr>
<td>Sphere (D)</td>
<td>Mean ± SD</td>
<td>-0.11 ± 0.23</td>
<td>-0.12 ± 0.31</td>
</tr>
<tr>
<td>Range</td>
<td>-0.50 to +0.25</td>
<td>-0.50 to +0.75</td>
<td></td>
</tr>
<tr>
<td>Cylinder</td>
<td>Mean ± SD</td>
<td>+0.19 ± 0.26</td>
<td>+0.24 ± 0.32</td>
</tr>
<tr>
<td>Range</td>
<td>0.00 to +0.75</td>
<td>0.00 to +1.25</td>
<td></td>
</tr>
<tr>
<td>UCVA</td>
<td>Mean logMAR ± SD</td>
<td>-0.08 ± .077</td>
<td>-0.07 ± .074</td>
</tr>
<tr>
<td>Snellen equivalent</td>
<td>≈ 20/17</td>
<td>≈ 20/17</td>
<td></td>
</tr>
<tr>
<td>20/15 or better, n (%)</td>
<td>26 (65%)</td>
<td>22 (55%)</td>
<td></td>
</tr>
<tr>
<td>20/20 or better, n (%)</td>
<td>38 (95%)</td>
<td>38 (95%)</td>
<td></td>
</tr>
<tr>
<td>20/25 or better, n (%)</td>
<td>40 (100%)</td>
<td>40 (100%)</td>
<td></td>
</tr>
<tr>
<td>BCVA</td>
<td>No change</td>
<td>33</td>
<td>35</td>
</tr>
<tr>
<td>Lines lost</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Gained ≥1 line</td>
<td>7</td>
<td>5</td>
<td>0.43</td>
</tr>
</tbody>
</table>

SE = spherical equivalent; UCVA= uncorrected visual acuity; BCVA = best corrected visual acuity

Discussion

Studies supporting the use of chilled saline irrigation in PRK to prevent pain and corneal haze are primarily from the 1990s and are based on outdated laser technology and surgical technique. The authors suggest that the cooling process may decrease pain by reducing inflammation and chemical mediators, such as prostaglandins (Kitazawa et al 1999; Nizuma et al 1994). Risk of corneal haze may be decreased by limiting thermal tissue damage and inhibiting the cytokine cascade that leads to keratocyte activation and fibroblast formation (Kitazawa et al 1999; Stein et al 1999). These initial reports and subsequent use patterns have perpetuated this practice and there is little or no current published evidence to validate early claims. Historically, surgeons and patients in our centers have often observed the process of using chilled saline irrigation after the laser ablation to be a subjectively uncomfortable, albeit brief, part of standard PRK procedure. Our current study helps demonstrate the safety and efficacy of using room temperature saline as an alternative to chilled saline in an effort to limit postoperative pain or corneal haze.

Although not statistically significant, there was a trend for the chilled group to experience more...
moderate to severe pain than the non-chilled group at the time of surgery. In retrospect, we did not design the study to specifically determine whether the irrigation step itself was more painful in one eye or the other, but rather compared the patient’s perception of pain for the overall surgical procedure. As most surgeons know, there is often a subjective difference in the amount of sensation or discomfort experienced in fellow eyes of the same patient at the same surgical event, despite identical anesthesia (Bartfield et al 1998). Treatment with bandage contact lenses, preservative free lubricants, topical corticosteroids and NSAIDs and PRN oral pain medications did not eliminate the pain, which increased for both groups in the first 36 hours after surgery. The use of oral analgesics (NSAIDs, narcotics, combination agents) was not controlled or standardized, however, since the study design was a contralateral eye study, and oral analgesics act systemically, both the chilled BSS and non-chilled BSS groups would likely be equally affected. Our study did not consider the use of dilute topical proparacaine which has been touted by some to be safe and effective for treating post-PRK pain (Shahinian et al 1997), but also has been associated with toxicity in other reports (Kim et al 1997; Moreira et al 1999).

Visual outcomes were excellent in both groups and there were no complications. No statistically significant differences were noted in visual acuity, refractive outcome, higher order aberrations, or in contrast sensitivity between the groups. Visually significant haze did not occur. This was somewhat expected because the number of patients in the study was relatively low, and their treatment was low to moderate myopia. A study with more patients and higher myopic treatments would better assess haze.

No prophylactic mitomycin C but only a fairly conservative topical steroid regimen was used in our study, and this was consistent with our current standard of care. A recent retrospective series had similar visual outcomes and no haze although it is not specified whether the saline irrigation used after the PRK was chilled (Bababeygy et al 2011). Given the low incidence of haze expected with modern PRK, it would be very difficult to prospectively and conclusively determine whether chilling the corneal surface helps prevent haze.

The question of the value of cooling the ocular surface after PRK ablation is still open. Ocular surface temperatures in the ambient environment have been measured in the 29 – 32 C range (Betney et al 1997) and in as high as 37 - 53 C after excimer laser ablation in human and rabbit models (Nizuma et al 1994; Betney et al 1997; Kitazawa et al 1997; Burns et al 1988). Direct temperature measurements of the ocular surface were not measured in our study, but it is likely that both groups had significant cooling due to irrigation. Room temperature, or non-chilled saline, at 16 to 20 C, may provide sufficient cooling to have a similar effect to chilled saline; however the relationship of effect is unclear.

Conclusion

This study questions the generally-accepted practice of using chilled saline to irrigate the corneal surface following excimer laser ablation during PRK. The use of non-chilled or room temperature saline irrigation appears to be equally effective and perhaps offers a more comfortable and convenient option for patients and surgeons. Similar outcomes were observed with regard to subjective pain, and excellent safety and visual results were achieved in both groups.

References


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Computer vision syndrome: a study of knowledge and practices in university students

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Abstract

Introduction: Computer vision syndrome (CVS) is a condition in which a person experiences one or more of eye symptoms as a result of prolonged working on a computer. Objectives: To determine the prevalence of CVS symptoms, knowledge and practices of computer use in students studying in different universities in Malaysia, and to evaluate the association of various factors in computer use with the occurrence of symptoms. Material and methods: In a cross sectional, questionnaire survey study, data was collected in college students regarding the demography, use of spectacles, duration of daily continuous use of computer, symptoms of CVS, preventive measures taken to reduce the symptoms, use of radiation filter on the computer screen, and lighting in the room. Results: A total of 795 students, aged between 18 and 25 years, from five universities in Malaysia were surveyed. The prevalence of symptoms of CVS (one or more) was found to be 89.9%; the most disturbing symptom was headache (19.7%) followed by eye strain (16.4%). Students who used computer for more than 2 hours per day experienced significantly more symptoms of CVS (p=0.0001). Looking at far objects in-between the work was significantly (p=0.0008) associated with less frequency of CVS symptoms. The use of radiation filter on the screen (p=0.6777) did not help in reducing the CVS symptoms. Conclusion: Ninety percent of university students in Malaysia experienced symptoms related to CVS, which was seen more often in those who used computer for more than 2 hours continuously per day.

Keywords: Computer vision syndrome, headache, eye strain, blurred vision

Introduction

Technological advances have made an impact in almost every aspect of our lives (office work, accounting, designing, medical facilities, database management, experimental work and daily tasks) after the availability of computers. A personal computer is a common item now-a-days in offices, colleges, universities and home. Its use has increased efficiency in easy access to information, writing articles, and communicating to others. Millions of people including children, college students are using computers for prolonged hours. A video display terminal (VDT) is also known as computer screen. The symptoms reported were eyestrain, tired eyes, headache, blurred vision, irritation, burning sensation, redness, double vision, neck pain, and backache which might be caused by combination of individual visual problems, poor
workplace conditions and improper work habits (Cole et al, 1996; Collins et al, 1998). However, eye related symptoms were reported as the most common health problem among VDT users (Shaheed, 1992; Costanza, 1994; Thomson, 1998). The condition of a person experiencing one or more of these eye symptoms as a result of operating a computer is generally referred as computer vision syndrome (CVS); and the symptoms have been divided broadly into four categories: (i) asthenopic — eye strain, tired eyes, sore eyes, (ii) ocular surface related — watering, irritation, dry eye, (iii) visual — blurred vision, slowness of focus change, double vision, and (iv) extraocular — neck pain, back ache, shoulder pain. (Blehm et al, 2005).

Now-a-days, large number of university students are using computers for studies and for research work. In addition, computers are used by them for seeing movies, playing computer games and online chatting. Pubmed search revealed only one report among the college students in India (Bhandari et al, 2008). There is no report available in the literature on computer vision syndrome in university students in Malaysia. Therefore, we conducted a questionnaire survey in students studying in different universities in Malaysia to determine the (i) prevalence of CVS symptoms, knowledge and practices of computer use, and (ii) to evaluate the association of various factors in computer use with the occurrence of symptoms.

This was a research project of students as part of the curriculum for phase II medical course in International Medical University, Kuala Lumpur.

**Material and methods**

A research questionnaire was prepared after reviewing the articles available on computer vision syndrome. The questionnaire included (i) demography details, (ii) spectacles use, (iii) computer use, (iv) symptoms of computer vision syndrome, (v) any measures practiced to prevent eye problems, (vi) use of radiation filter, and (vii) lighting in the room. Data collected in questions (iii) and (iv) provide information on knowledge and in questions (v), (vi) and (vii) provide information on practices of computer use.

A pilot study was conducted among 20 undergraduate students of different faculties (medical, pharmacy and nursing) from International medical university and the questionnaire was edited for easy understanding by the respondents. Following this, a cross sectional survey was carried out in students from colleges of different universities in Malaysia from April 2007 to September 2007.

After making sure that the respondents were using the computer daily for one hour or more over a period of some months/years, the students were explained about the objectives of the research project, confidentiality of the data collected; and verbal consent was taken for their willingness to participate in the study. All the students agreed for participation in the study and hence, all of them were taken as sample for this study.

All the students present in the class at the time of giving the questionnaire were included in the study as per the inclusion criteria. After collecting the filled up pro formas from the students, they were checked for the responses in all the sections. The pro formas from the students with insufficient data were excluded from the study as per the exclusion criteria. The data was collected in a proforma (Appendix-1) and analyzed using SPSS version 16.0 program.

**Appendix-1 Research questionnaire for computer vision syndrome**

Please fill up the blank or circle the appropriate word in all the questions

(i) **Demography**

Age: .... years  
Gender: male/ female  
Race: malay/ chinese/ indian/ others ...............  
Name of University ........................................

(ii) **Spectacle use**

Are you wearing glasses: yes/no  
If yes, duration of wearing glasses: .... months/years  
Power of glasses:  Right eye .......................  
Left eye ............................

162
Are you wearing contact lenses: yes/no
If yes, duration of wearing contact lenses: ...... months/ years

(iii) Computer use
How long have you been using computer? .......... months/ years
Average duration of computer use in a day: ......... hours
Are you aware that prolonged use of computer has bad effects on the eyes?: yes/ no

(iv) Computer vision syndrome symptoms
• Have you experienced any one of the following symptoms while using/after finishing the work on computer? You can circle more than one as answer.
  Eye strain (irritation, heaviness)/ tiredness of eyes/watering of eyes/redness of eyes/blurring of vision/dry eye/ discomfort/ double vision/ headache/ backache/ neck pain/ shoulder pain/ no symptoms.
• What is the most disturbing symptom? You should circle only one as answer.
  Eye strain (irritation, heaviness)/ tiredness of eyes/watering of eyes/redness of eyes/blurring of vision/dry eye/ discomfort/ double vision/ headache/ backache/ neck pain/ shoulder pain/ no symptoms.
• After how many hours of computer use you experience the above symptoms? ...... hours

(v) Preventive measures
• Do you practice any of the following measures to prevent/ relieve the above symptoms? You can circle more than one as answer.
  Taking breaks in between use/ looking at far objects in between use/ massage of eyes/ use of eye drops/ use of radiation filter on the screen/

(vi) Level of the computer screen
At what level is your computer screen during work? ......above the eye level/ at the eye level/ below the eye level

(vii) Lighting in the room
What type of lighting is used in the room? ....
Fluorescent light/natural light.

If the student had experienced at least one symptom during/following use of computer, he/she was considered to be having symptom of CVS. Some of them might have experienced more than one symptom. Therefore, to determine the association of various factors with the presence or absence of symptoms, all the symptoms were added together (cumulated number) for statistical purpose. Thus, the total number of symptoms are much more than the number of students. Chi square test was used to evaluate the significance of symptoms with various factors during computer use. A p value <0.05 was taken as statistically significant.

Results
A total of 843 students were recruited in this study, of which 795 students responded all the seven parts of the questionnaire completely (response rate 94.3%). Majority of the participant students were from International Medical university (Table 1).

Table 1: Number of participant students from different universities in Malaysia (n=795)

<table>
<thead>
<tr>
<th>Name of university</th>
<th>No. of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>International Medical University</td>
<td>313</td>
</tr>
<tr>
<td>University Putra Malaysia</td>
<td>201</td>
</tr>
<tr>
<td>Multimedia University, Melaka Campus</td>
<td>143</td>
</tr>
<tr>
<td>Melaka Manipal Medical College</td>
<td>99</td>
</tr>
<tr>
<td>Penang Medical College</td>
<td>39</td>
</tr>
</tbody>
</table>

Females were more (482, 60.6%) in our study than males (313, 39.4%). The mean age of students was 21.3 years (range 18 - 25 years). Chinese students were 387 (48.7%) followed by Malays 290 (36.5%), Indians 91 (11.4%) and others — different races of foreign students 27 (3.4%). Out of 795 students 543 were wearing spectacles (68.3%); 172 of them were using contact lenses and all were myopes and some had astigmatism also. The mean duration of daily computer use was 3.5 hours (range 1 - >10 hours), Table 2.
There was no significant difference of mean duration of daily computer use between the two genders (males 3.9 hours and females 3.2 hours \((p=0.7)\). Majority of students (87\%) were aware of the bad effects of prolonged use of computer on the eye. The mean total duration of computer use (by all students) was 8.9 years (range 10 months - 15 years). Seven hundred and fifteen (89.9\%) students had one or more symptoms of CVS, while 80 (10.1\%) did not have any symptoms. The most disturbing symptom was headache (19.6\%) followed by eye strain (16.4\%), Table 3.

### Table 2: Duration of daily computer usage in male and female students

<table>
<thead>
<tr>
<th>Daily computer use</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 hour</td>
<td>71</td>
<td>145</td>
<td>216</td>
</tr>
<tr>
<td>2 hours</td>
<td>69</td>
<td>45</td>
<td>114</td>
</tr>
<tr>
<td>3 hours</td>
<td>49</td>
<td>72</td>
<td>121</td>
</tr>
<tr>
<td>4 hours</td>
<td>27</td>
<td>43</td>
<td>70</td>
</tr>
<tr>
<td>5 hours</td>
<td>32</td>
<td>46</td>
<td>78</td>
</tr>
<tr>
<td>6 hours</td>
<td>39</td>
<td>34</td>
<td>73</td>
</tr>
<tr>
<td>7 hours</td>
<td>8</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>8 hours</td>
<td>6</td>
<td>20</td>
<td>26</td>
</tr>
<tr>
<td>9 hours</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>&gt;10 hours</td>
<td>10</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>313</td>
<td>482</td>
<td>795</td>
</tr>
</tbody>
</table>

The association of various factors in computer use with the occurrence of symptoms of CVS is shown in Table 4. Students who used computers for more than 2 hours experienced symptoms of CVS significantly more often than those who used computer up to 2 hours \((p=0.0001)\). Students who were wearing spectacles experienced symptoms significantly more often than those who were not wearing spectacles \((p=0.0001)\). However, there was no statistically significant difference between students who were high myopes than those who were low and moderate myopes together \((p=0.2927)\).

Taking breaks in between the use of computer (547, 68.8\%) was the most common preventive measure taken for relief of symptoms of CVS; the mean duration of time taken was 15 minutes (range 5 – 60 minutes). However, there was no statistically significant association between taking breaks during the use of computer and relief of symptoms \((p=0.3238)\). Looking at far objects in-between the work \((p=0.0008)\), massage of eyes \((p=0.0021)\), use of eye drops \((p=0.0001)\) were found statistically useful in reducing the CVS symptoms.

Majority of students (610, 76.7\%) were not using any radiation reducing filter on the monitor. The use of this filter did not help the students in reducing the symptoms of CVS \((p=0.6615)\). There was significant reduction in symptoms of CVS between students who viewed the computer screen below eye level than those who viewed the screen at or above the eye level \((p=0.0001)\).

While working on the computer, 649 (81.6\%) students used fluorescent light in the room; 106 (13.3\%) utilized natural sunlight available in the room; 22 (2.8\%) used other forms of lighting; while 18 (2.3\%) worked without any light in the room. There was no statistically significant difference between CVS symptoms and presence of fluorescent lighting in the room \((p=0.3056)\).
Table 4: Association of various factors associated with computer usage and occurrence of cumulated symptoms of computer vision syndrome (CVS)

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. of students</th>
<th>CVS symptoms present</th>
<th>No symptoms</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Duration of computer use</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to 2 hours</td>
<td>330</td>
<td>1716</td>
<td>1647</td>
<td>0.0001</td>
</tr>
<tr>
<td>More than 2 hours</td>
<td>465</td>
<td>1684</td>
<td>2133</td>
<td></td>
</tr>
<tr>
<td><strong>Wearing spectacles</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>543</td>
<td>2559</td>
<td>3414</td>
<td>0.0001</td>
</tr>
<tr>
<td>No</td>
<td>252</td>
<td>993</td>
<td>1779</td>
<td></td>
</tr>
<tr>
<td><strong>Degree of myopia</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>upto -6 dioptres</td>
<td>412</td>
<td>1971</td>
<td>2561</td>
<td>0.2927</td>
</tr>
<tr>
<td>&gt;6 dioptres</td>
<td>78</td>
<td>356</td>
<td>502</td>
<td></td>
</tr>
<tr>
<td><strong>Preventive measures</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taking breaks</td>
<td>Yes</td>
<td>547</td>
<td>2465</td>
<td>3552</td>
</tr>
<tr>
<td>In-between work</td>
<td>No</td>
<td>248</td>
<td>1087</td>
<td>1641</td>
</tr>
<tr>
<td>Looking at far</td>
<td>Yes</td>
<td>431</td>
<td>2003</td>
<td>2738</td>
</tr>
<tr>
<td>objects in-between work</td>
<td>No</td>
<td>364</td>
<td>1549</td>
<td>2455</td>
</tr>
<tr>
<td>Massage</td>
<td>Yes</td>
<td>402</td>
<td>1867</td>
<td>2555</td>
</tr>
<tr>
<td>of eyes</td>
<td>No</td>
<td>383</td>
<td>1685</td>
<td>2638</td>
</tr>
<tr>
<td>Use of</td>
<td>Yes</td>
<td>203</td>
<td>996</td>
<td>1237</td>
</tr>
<tr>
<td>eye drops</td>
<td>No</td>
<td>592</td>
<td>2556</td>
<td>3956</td>
</tr>
<tr>
<td>Use of radiation</td>
<td>Yes</td>
<td>185</td>
<td>818</td>
<td>1217</td>
</tr>
<tr>
<td>filter on screen</td>
<td>No</td>
<td>610</td>
<td>2734</td>
<td>3976</td>
</tr>
<tr>
<td><strong>Level of computer screen</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At or above eye level</td>
<td>599</td>
<td>2678</td>
<td>1667</td>
<td>0.0001</td>
</tr>
<tr>
<td>Below eye level</td>
<td>196</td>
<td>874</td>
<td>3615</td>
<td></td>
</tr>
<tr>
<td><strong>Lighting in the room</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluorescent lighting</td>
<td>777</td>
<td>3479</td>
<td>5057</td>
<td>0.3056</td>
</tr>
<tr>
<td>Natural lighting</td>
<td>18</td>
<td>73</td>
<td>125</td>
<td></td>
</tr>
</tbody>
</table>

Discussion

The prevalence of computer vision syndrome (CVS) symptoms in our study was 89.9%, of which eye strain (asthenopia) was 16.4%. A much higher frequency of asthenopia has been reported from different countries — 31.9% from Italy (Mocci et al, 1996), 46.3% from India (Bhanderi et al, 2008), 68.5% from Spain (Sanchez-Roman et al, 1996), among computer users. Mutti and Zadnik (1996) from USA reported that 75% of computer users who worked for long hours at the computer had complaints of visual symptoms.

The most common two symptoms of CVS reported in the literature are shown in Table 5.

Table 5: Frequency of most common two symptoms reported in computer users

<table>
<thead>
<tr>
<th>Author and year</th>
<th>Most common two symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First</td>
</tr>
<tr>
<td>Shrestha et al (2011)</td>
<td>Headache (13.3%)</td>
</tr>
<tr>
<td>Edema &amp; Akwukwuma (2010)</td>
<td>Tired eyes (62.5%)</td>
</tr>
<tr>
<td>Megwas &amp; Daguboshim (2009)</td>
<td>Headache (41.7%)</td>
</tr>
<tr>
<td>Bali et al (2007)</td>
<td>Eye strain (97.8%)</td>
</tr>
<tr>
<td>Singh et al (2007)</td>
<td>Burning sensation (31%)</td>
</tr>
<tr>
<td>Smith et al (1981)</td>
<td>Eye strain (91%)</td>
</tr>
<tr>
<td>Present Study</td>
<td>Headache (19.7%)</td>
</tr>
</tbody>
</table>
The symptoms of headache, eye strain, dryness, burning, grittiness, heaviness or watering, stiff shoulders, low back pain and general fatigue were reported higher with increasing duration of daily VDT use (Acousta et al, 1999; Nakazawa et al, 2006). The duration of computer work is directly related to eye symptoms; and longer duration tends to result in long-lasting complaints even after the work is finished (Bergqvist and Knave, 1994; Sanchez-Roman et al,1996; Shima et al, 1995).

In our study, more than 2 hours continuous use of computer was significantly associated with occurrence of CVS symptoms (Table-4). Mutti and Zandic (1996) reported more pronounced visual symptoms in people spending 6-9 hours daily at a computer, while Stella et al (2007) observed the same in people using computer more than 8 hours daily. Spending long time on the computer screen without pause also can lead to problem of shifting focus on screen, documents and keyboard. The constant process of drifting and refocusing on fuzzy pixel of texts on the screen can leave eyes strained and fatigued (Wimalasundara, 2006).

Computer work place illumination, screen contrast, duration of work on computer, viewing distances and angles, specific work related task, pressure and interest, screen reflection, image quality, and work place ergonomics were found to have significant role in manifesting symptoms in VDT users (Stella et al, 2007; Cole, 2003). The level of the computer screen can be at or above or below the eye level of computer user. A higher proportion of subjects who had their computer screen at or above the eye level reported asthenopia (Bhanderi et al, 2008; Jaschinski et al, 1998; Bergqvist and Knave, 1994).

The following strategies have been reported by the researchers to prevent/ reduce the symptoms of CVS: (i) Keeping the computer screen at a distance of 35-40 inches away may allow the eyes to relax and may reduce eye strain (Jaschinski et al, 1998). (ii) Adjusting the computer monitor to a viewing angle of 15° lower than horizontal level may reduce the musculoskeletal discomfort (neck pain and back pain) and visual discomfort (Psihogios et al, 2001). In our study, there was significant reduction in symptoms of CVS between students who viewed the computer screen below eye level than those who viewed the screen at or above the eye level (Table-4), (iii) Taking regular small breaks may relax accommodation process of the eyes, thereby preventing eye strain (Mc Lean et al, 2001). Taking breaks in between the use of computer was the most common preventive measure taken for relief of symptoms of CVS. However, there was no statistically significant association between taking breaks during the use of computer and relief of symptoms (Table-4). It will be easy to practice the small breaks in between the work by following the rule of 20/20/20 as suggested by Anshel (2005) i.e. after 20 minutes of computer use, one should look at something 20 feet away for 20 seconds. In our study, looking at far objects in-between the work was significantly associated with less frequency of CVS symptoms (Table-4). (iv) Maintaining good sitting posture to avoid neck pain and back pain (Liao and Drury, 2000). (v) Correction of visual problems by wearing spectacles or contact lenses is important to avoid eye strain (Sheedy, 2000). (vi) The screen lighting, contrast and brightness should be adjusted to the optimum before starting the work on the computer. The luminance of the room should not exceed three times than the mean luminance on the screen (Sheedy et al, 2005).

Artificial tears (Bali et al, 2007), herbal eye drops - itone (Biswas et al, 2003), polysorbate 0.5% - optizen and tetrahydrozaline 0.05% - visine (Skilling et al, 2005), povidone 2% preservative- free eye drops (Gullion et al, 2004) have been prescribed to alleviate the symptoms related to CVS. In our study, use of eye drops...
was significantly associated with less frequency of CVS symptoms (Table-4). These eye drops rewet the ocular surface, contribute to tear volume; and thus decrease symptoms of ocular tiredness, dryness and difficulty in focus, thus improve dynamic visual acuity.

**Conclusion**

From the present study, it is concluded that 90% of university students in Malaysia experienced one or more symptoms of computer vision syndrome. The most common symptom was headache, followed by eye strain. The symptoms were reported more often in students who used computers for more than 2 hours in a day. Looking at far objects in-between work, viewing the monitor below the eye level, massage of eyes, and use of eye drops helped in reducing the symptoms. Taking rest in-between the work, use of radiation reducing filters on the monitor did not help in reducing the symptoms.

**References**


display terminal (VDT) operators in Owerri, Nigeria, JNOA; 15:33-36.


Source of support: nil. Conflict of interest: none
Retinoblastoma: geographic distribution and presentation at a tertiary eye care centre in Kathmandu, Nepal

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Abstract

Introduction: Several aspects of retinoblastoma in Nepal remain enigmatic. Objective: To assess the demographic and geographic distribution, clinical presentation, and treatment methods of retinoblastoma at a tertiary level ophthalmic institution in Kathmandu, Nepal. Materials and methods: A retrospective analysis of all the patients diagnosed with retinoblastoma at Tilganga Institute of Ophthalmology from July 2004 to June 2008 was performed. The main outcome measures included region of residence, treatment options and histopathological findings. The histopathological analysis was performed on enucleated and exenterated specimens. Statistics: The statistical analysis was performed with SPSS Version 11.5. Descriptive statistics are represented as mean ± standard deviation. All tests were two-sided and the P-values of less than 0.05 were considered statistically significant. Results: Thirty patients presented with retinoblastoma during the study period. The mean age at presentation was 2.5 ± 1.6 years (range five months to seven years). Ten of the 12 patients who presented with bilateral retinoblastoma (83 %) were from the Terai region of Nepal. The ratio of unilateral to bilateral cases in the Terai region was 1:2. This differed significantly with the ratio in the hilly region (Fisher’s Exact Test, p = 0.0012). The mean duration of symptoms before presentation was 2.5  3.2 months (range three days to 12 months). Twenty-four patients (80 %) presented with leukocoria. Eleven patients (36.6 %) presented with leukocoria as their only symptom. Ninety-seven percent of the patients underwent either enucleation (90 %) or exenteration (6.7 %) of at least one eye. Conclusion: Bilateral retinoblastoma is more prevalent in the Terai region of Nepal. The majority of the patients present with leukocoria and are treated with enucleation.

Keywords: Clinico-histopathology, geographic distribution of Nepal, retinoblastoma

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Introduction

Although extremely rare in the general population, retinoblastoma (RB) remains the most common primary intraocular malignancy expressed in the pediatric patients amongst all populations (Shields, 1992). However, the incidence of retinoblastoma varies significantly according to socioeconomic status and between developed and developing nations (Stiller and Parkin, 1996). The rate of retinoblastoma in the United States is 10.9 per million in children under five years, and it is 9.1 per million in children under six years in New South Wales (Tamboli et al, 1990; Azar, et al, 2006). In the Netherlands, the rate of retinoblastoma has held steady at 1 per 17,000 live births since 1945 (Moll et al, 1997). In contrast, the rate of retinoblastoma in India is
estimated to be as much as 4.4 times that of the
United States (Schultz et al, 1993). A discrepancy
between the presenting signs of retinoblastoma
also exists between developing and developed
countries. In Western countries, retinoblastoma is
typically diagnosed early and leukocoria is the
presenting sign in 40 - 60 % of patients
(Pendergrass and Davis 1980; Suckling,
Fitzgerald et al, 1982; Abramson et al, 1998). In
Nepal, retinoblastoma is often not diagnosed until
later stages, with proptosis and fungating mass
comprising a higher proportion of the mode of
presentation, and thus prognosis is often much
worse due to increased likelihood that the tumor
has spread to the optic nerve (Badhu et al, 2005;
Saiju et al, 2006). Hence, the primary treatment
in Nepal remains enucleation or exenteration of
at least one eye, and, in cases of bilateral
retinoblastoma, cryotherapy, photocoagulation,
and chemotherapy in the eye with the less
advanced stage of the disease (Saiju et al, 2006).
Although studies have demonstrated a significant
difference between the incidence and severity
of RB in Nepal and the developed world, many
aspects of RB in Nepal remain enigmatic.

We sought to elucidate the presentation and
progression of retinoblastoma in Nepal by evaluating
the demographic distribution, clinical presentation,
and method of treatment in retinoblastoma patients.
As Nepal is geographically divided into three distinct
regions, according to elevation and land type, this
study also classified patients according to their region
of residence in order to identify any geographic
trends. These regions are the Mountain Region (e.g.
the Himalayas in the northernmost region of Nepal),
the Hill Region (central region of Nepal), and the
Terai region (low elevation marshland near the
Indian border in the southern region of Nepal)
(Shambu, 2007).

Materials and methods
A retrospective analysis was performed on all cases
of retinoblastoma that presented at the Tilganga
Institute of Ophthalmology, a Tertiary Eye Care
Centre (TECC) in Kathmandu, Nepal, between
July 2004 and June 2008. A detailed history of each
patient that included presenting complaints, history
and duration of present illness, family history,
treatment history, age, sex, and place of residence
was taken.

All patients were subjected to an external ocular
examination. The state of the lids/adnexa, extra-
ocular movement, and presence or absence of
vitreous seeding were noted. Visual acuity was also
recorded. Anterior segment evaluation was
performed via Slit-Lamp Biomicroscopy (Haag-
Streit Burn 900 or a Shin Nippon Hand-Held Slit
Lamp). Fundus evaluation after full pupil dilation
was performed with both direct and indirect
ophthalmoscopy (Heine with Volk +20D). When
tumors were present, their size, quadrant, number,
and location were noted. IOP was measured using
Perkin’s tonometry.

Following diagnosis of retinoblastoma, the available
treatments included enucleation, exenteration,
cryotherapy, photocoagulation, radiotherapy and
chemotherapy. Enucleation was indicated by tumor
size greater than or equal to one half of the total
retinal diameter. All patients with bilateral
retinoblastoma received photocoagulation at the
TECC. The patients were referred to an oncology
unit of a nearby hospital for chemotherapy and
radiotherapy. A complete histopathological analysis
was performed on all enucleated/exenterated
specimens. Specimens were classified according to
the cell type (well versus poorly differentiated), optic
nerve infiltration and orbital infiltration.

All data utilized in this study was collected via chart
review and then entered onto a standardized form.
Data was subsequently entered into Microsoft Excel
2007. All statistical analysis was performed with
SPSS Version 11.5. Descriptive statistics were
represented as mean ± standard deviation. All the
tests were two-sided and the P-values of less than
0.05 were considered statistically significant.

Results
Thirty patients with retinoblastoma presented at the
TECC during the study period. The mean age at
presentation was 2.5 ± 1.6 years (range five months to seven years). The mean duration of symptoms before presentation at the TECC for examination was 2.5 ± 3.2 months (range: three days to 12 months). Table 1 shows the mean age at presentation and the mean duration of symptoms for male and female and the laterality of involvement. The majority of patients (83%) were three years old or younger. There were no significant differences between age at presentation or duration of symptoms prior to treatment between the male and female patients (p = 0.423 and p = 0.820, respectively).

Table 1: Mean age at presentation and duration of symptoms before presentation

<table>
<thead>
<tr>
<th>Region</th>
<th>Unilateral</th>
<th>Bilateral</th>
<th>Combined Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hill (Central)</td>
<td>2.3 ± 1.3</td>
<td>2.8 ± 2.0</td>
<td>2.5 ± 1.6</td>
</tr>
<tr>
<td>Terai (Southern)</td>
<td>2.4 ± 1.6</td>
<td>2.8 ± 1.8</td>
<td>2.8 ± 1.8</td>
</tr>
<tr>
<td>Mountain (Northern)</td>
<td>3.0 ± 3.9</td>
<td>1.7 ± 1.3</td>
<td>3.3</td>
</tr>
</tbody>
</table>

Out of 30 cases, 18 (60 %) had unilateral involvement and 12 (40 %) had bilateral involvement (Table 3). The male/female ratio was 1.3:1. All patients had a negative family history for retinoblastoma. There was no statistical difference between the proportions of males and females who developed unilateral versus bilateral retinoblastoma (p = 0.88).

Table 2: Regional distribution of laterality amongst the three regions of Nepal

<table>
<thead>
<tr>
<th>Gender</th>
<th>Laterality</th>
<th>Unilateral (n, %)</th>
<th>Bilateral (n, %)</th>
<th>Total (n, %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>Unilateral</td>
<td>10 (33%)</td>
<td>7 (23%)</td>
<td>17 (57%)</td>
</tr>
<tr>
<td></td>
<td>Bilateral</td>
<td>8 (27%)</td>
<td>5 (17%)</td>
<td>13 (43%)</td>
</tr>
<tr>
<td></td>
<td>Combined</td>
<td>18 (60%)</td>
<td>12 (40%)</td>
<td>30 (100.0%)</td>
</tr>
</tbody>
</table>

The only patient with bilateral retinoblastoma residing in the Hill region was from the far eastern part of the country near the Indian border. Bilateral RB was significantly more common in the Terai region, whereas unilateral RB was much more prevalent in the Hill region. Thirteen of the 18 patients (72.2%) with unilateral retinoblastoma resided in the Hill region, and five (27.8%) resided in the Terai region (Table 2). No patients with unilateral retinoblastoma resided in the Mountain region. When the Terai and Hill regions were compared, the association between the region of residence and bilateral involvement was highly significant (p = 0.0012, Fisher’s Exact Test).

The patients were also classified according to the ethnic groups and religious affiliation. Eleven ethnic groups were represented amongst the 30 patients. In this study, only one of the 30 patients was Muslim, 23 were Hindus, and 6 were Buddhists.

Twenty-four patients (80%) presented to the TECC with leukocoria. Of these patients, 11 (36.6%) presented with leukocoria as their only symptom, and 13 had additional symptoms (Table 4). In all patients who presented with leukocoria, the mean duration of presenting symptoms was 2.6 ± 3.5 months, and in patients with leukocoria as their only presenting symptom, the mean duration of symptoms before presentation was 1.9 ± 1.6 months. Twelve patients (40%) presented with a red eye, and this was associated with an average duration of symptoms of 3.2 months. With one exception, all patients presenting with red eye also presented with additional symptoms, including leukocoria and “other” symptoms. Twelve (40.0%) patients presented with other symptoms (e.g. watery eye, swelling, tenderness, etc.) All patients who presented with “other” symptoms also presented with leukocoria or red eye.
Table 4: Frequency of presenting symptoms with duration of symptoms

<table>
<thead>
<tr>
<th>Frequency (Percent)</th>
<th>Presenting symptom</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Leukocoria only</td>
</tr>
<tr>
<td>11 (37%)</td>
<td>24 (80%)</td>
</tr>
<tr>
<td>Mean duration of presentation (in months)</td>
<td>1.9±1.6</td>
</tr>
</tbody>
</table>

N/A: not applicable

Five of the cases in this study had their histopathology reports missed, and one patient diagnosed with unilateral retinoblastoma did not undergo surgery. Cases without the histopathology scores were otherwise reflective of the rest of the patient cohort in terms of age and time to treatment. Table 5 illustrates the histopathological findings in the remaining 24 cases. Poorly differentiated and well differentiated tumors were present in nearly equal proportions in this study. Ten of the 13 patients with poorly differentiated tumors had a unilateral retinoblastoma (Table 5). This distribution of poorly differentiated, unilateral tumors versus other tumors was not statistically significant (Fisher’s Exact Test, p=0.12). Well differentiated tumors were present in near equal proportions in unilateral and bilateral cases. Patients with well differentiated tumors experienced symptoms for an average of 1.8 months before reporting to the TEC, whereas those with poorly differentiated tumors experienced symptoms for 3.4 months, but the difference was not statistically significant (p = 0.237, T-Test). Seven of the 9 patients with an affected optic nerve had unilateral retinoblastoma. Patients with an affected optic nerve experienced symptoms for 4.9 months on average before reporting to the TEC, while patients with an unaffected optic nerve only experienced symptoms for 1.3 months, and this difference was statistically significant (p = 0.009, T-Test). Both patients with orbital infiltration had unilateral retinoblastoma and had experienced symptoms for an average of seven months before reporting to the TEC. Well differentiated tumors presented at an earlier age than poorly differentiated tumors, and patients without optic nerve infiltration presented at an earlier age than those with optic nerve infiltration. The difference in age of presentation amongst patients with well differentiated tumors versus those with poorly differentiated tumors was not statistically significant (p = 0.0596, T-Test), but the difference in age between the patients with affected versus unaffected optic nerves was significant (p = 0.0037, T-Test).

Table 5: Histo-pathological findings with duration of symptoms and age at presentation

<table>
<thead>
<tr>
<th>Histopathology</th>
<th>Frequency (percent)</th>
<th>Poorly differentiated</th>
<th>Well differentiated</th>
<th>Optic nerve affected</th>
<th>Optic nerve unaffacted</th>
<th>With orbital infiltration</th>
<th>Without orbital infiltration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unilateral</td>
<td>3 (12%)</td>
<td>3 (12%)</td>
<td>6 (25%)</td>
<td>4.9±4.5</td>
<td>1.3±1.3</td>
<td>7.0±7.1</td>
<td>2.3±2.8</td>
</tr>
<tr>
<td>Bilateral</td>
<td>10 (42%)</td>
<td>11 (46%)</td>
<td>9 (38%)</td>
<td>15 (63%)</td>
<td>2 (8.3 %)</td>
<td>22 (92%)</td>
<td></td>
</tr>
<tr>
<td>Mean duration of symptoms (months)</td>
<td>3.4±4.3</td>
<td>1.8±1.5</td>
<td>4.9±4.5</td>
<td>1.3±1.3</td>
<td>7.0±7.1</td>
<td>2.3±2.8</td>
<td></td>
</tr>
<tr>
<td>Mean age at presentation (years)</td>
<td>3.0±1.4</td>
<td>1.8±1.4</td>
<td>3.6±1.6</td>
<td>1.8±1.0</td>
<td>3.5±0.7</td>
<td>2.4±1.5</td>
<td></td>
</tr>
</tbody>
</table>
A total of 97% of the patients underwent either enucleation (90%) or exenteration (6.7%) of at least one eye (Table 6). Even in cases when leukocoria was the only presenting symptom, all tumors occupied more than half of the retina. One patient did not undergo any treatment following diagnosis. All bilateral eyes received photocoagulation at the TEC in the less affected eye. Exenteration was performed in cases with extraocular involvement. In bilateral cases, the eye with the more advanced disease was treated surgically. Although all bilateral patients were referred for chemotherapy and radiotherapy, only 9 of the 12 bilateral patients (75.0%) underwent chemotherapy, 6 (50%) photocoagulation and 1 (8%) radiotherapy. No patient in this study was elected to undergo cryotherapy. The patients with unilateral or bilateral retinoblastoma that had infiltrated optic nerve were referred for chemotherapy. Six of the seven of these patients underwent chemotherapy. Orbital extension was present in one case, and this patient underwent exenteration but did not undergo chemotherapy. One patient with unilateral retinoblastoma without optic nerve infiltration also underwent chemotherapy. This accounts for the seven unilateral patients who underwent chemotherapy.

Table 6: Frequency of treatments and treatment according to laterality

<table>
<thead>
<tr>
<th>Laterality</th>
<th>Treatment</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Enucleation (n, %)</td>
<td>15</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>Exenteration (n, %)</td>
<td>2</td>
<td>6.7%</td>
</tr>
<tr>
<td></td>
<td>Photocoagulation (n, %)</td>
<td>1</td>
<td>3.3%</td>
</tr>
<tr>
<td></td>
<td>Radiotherapy (n, %)</td>
<td>2</td>
<td>6.6%</td>
</tr>
<tr>
<td></td>
<td>Chemotherapy (n, %)</td>
<td>7</td>
<td>23%</td>
</tr>
<tr>
<td>Unilateral</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bilateral</td>
<td>12</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>3.3%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9</td>
<td>30%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>27</td>
<td>90%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>6.7%</td>
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<tr>
<td></td>
<td></td>
<td>7</td>
<td>23%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>16</td>
<td>53%</td>
</tr>
</tbody>
</table>

Discussion
Whereas previous studies have found the distribution of bilateral to total cases of retinoblastoma to be around 20 - 30% (Amozorrutia-Alegria et al, 2002; Kaimbo et al, 2002), this study documented a bilateral rate of 40%. This is also higher than the 9% - 24% reported in previous studies from Nepal (Badhu et al, 2005; Saiju et al, 2006). Of particular interest is the unique geographic distribution of unilateral and bilateral tumors noted in this study. All cases of bilateral retinoblastoma are inherited, whereas about 90% of unilateral cases arise sporadically (Vogel, 1979). The RB1 gene is located on chromosome 13q14 and retinoblastoma results when a deletion occurs at this locus. Hereditary (bilateral) retinoblastoma has an autosomal dominant pattern of inheritance. In Nepal, the discrepancy between occurrences of unilateral versus bilateral retinoblastoma in the Hill region and the Terai region was highly significant (Fisher’s Exact Test, p=0.0012). Ten of the 12 patients who presented with bilateral retinoblastoma (83%) were from the Terai region. Of all the patients who presented from the Terai region, 64% had a bilateral retinoblastoma, which is nearly double the usual rate reported in developed countries (Vogel 1979; Stiller and Parkin, 1996; Moll et al, 1997) and more than triple the rate recorded in Nepal when considered as a whole (9% - 24%) (Badhu et al, 2005; Saiju et al, 2006). Of the 18 patients who presented with unilateral retinoblastoma, 13 (72%) were from the hill region. Of these 13 patients, 8 were from Kathmandu or a district on its immediate border. Of all the patients who presented from the hill region, 86.7% had a unilateral retinoblastoma. Although higher than the unilateral proportion of total cases reported outside of Nepal (60 - 70%) (Vogel 1979; Stiller and Parkin 1996; Moll et al, 1997), this is within the range previously reported in Nepal (76% - 91%) (Badhu et al, 2005; Saiju et al, 2006).

In a study by Stiller et al, differences in the proportions of unilateral versus bilateral retinoblastoma were displayed according to
geography. However, these differences were classified according to the country, and for the United States, according to cultural background (e.g. white, black, Navajo Native American) (Stiller and Parkin, 1996). Our study is unique in that it demonstrates the significant difference in distribution of unilateral versus bilateral retinoblastoma between different geographic regions of the same country.

Recent studies by Orjuela et al (2000) and Palazzi et al (2003) have both shown the presence of HPV in retinoblastoma tumor tissue, thus suggesting a link between HPV infection and retinoblastoma. Although there are no studies of the prevalence of HPV in Nepal, several studies have demonstrated an increased incidence of HPV amongst infection in urban populations as opposed to rural populations (Stone et al, 2002; Kliucinskas et al, 2006). This could possibly account for the increased prevalence of unilateral retinoblastoma in Kathmandu and its surrounding areas. The prevalence of HPV in retinoblastoma in Nepal and the prevalence of HPV in Nepal as a whole are subject to further study.

Regarding the increased frequency of bilateral retinoblastoma in the Terai region, several factors may be involved. When compared with every district of the Hill region, excluding Kathmandu and Lalitpur, the districts of the Terai region have a substantially higher proportion of foreign-born inhabitants (Shambu RJ, 2007). As there are few terrain barriers separating the Terai region from northern India, a majority of these foreign inhabitants have probably migrated from India. Unlike from northern India, the Terai region is separated from the hilly region of Nepal, including the Kathmandu valley, by significant terrain barriers (e.g. high hills) and a lack of adequate transportation routes in the form of highways and railroads (Shambu, 2007). Thus, Nepal’s natural landscape may have kept retinoblastoma carriers isolated in the Terai region.

According to the Integrated Regional Information Network (IRIN) and the CIWEC travel medicine center, with the exception of the Tharu ethnic group, who had natural resistance to malaria, the Terai region was largely uninhabited until the late 1950’s when the USAID helped to establish a malaria eradication program in the region (CIWEC, 2006; IRIN, 2008). Following this, a mass migration occurred, and now the Terai region is the most populated region of the country. Unfortunately, information regarding the prevalence of retinoblastoma in the Terai region prior to 1960 does not exist. As considerable inbreeding amongst the Tharus probably occurred prior to the population influx of the late 1950’s, measurement of the prevalence of bilateral retinoblastoma and its alleles amongst this ethnic group is a potential area for further study.

In this study, patients were also separated according to ethnic group. Amongst 30 patients, 11 ethnic groups were present. Hence, distribution according to ethnic group could not be measured with statistical validity.

Badhu et al (2005) suggested that the increased prevalence of bilateral retinoblastoma in the Terai region may be due to consanguineous marriages amongst the Muslim parents, who comprised a higher proportion of the patients with retinoblastoma in the Terai. In this study, one patient out of 30 was Muslim, 23 were the Hindus, and six were Buddhists. Hence, consanguineous marriage amongst the Muslim patients did not play a role in the increased rate of bilateral retinoblastoma reported in the Terai region in this study.

All of the aforementioned hypotheses for the geographical distribution of retinoblastoma in Nepal are subject to further study. The results of this study indicate that the alleles that cause bilateral retinoblastoma, or environmental factors that increase the penetrance of these alleles, may be present at a much higher rate in the Terai region of Nepal than in the Hill region.

Previous studies on retinoblastoma in Nepal reported that a significant proportion of patients experienced symptoms for an extended duration of time before they underwent examination. In one study, 42 % of patients had experienced symptoms for over 12 months before consulting...
a physician, while in the other, 63% of patients waited six months or longer. This study showed a significant decrease in the duration of symptoms before examination, with a mean lag time of 2.5 ± 3.2 months. Although not statistically significant, this study also found that female patients experienced symptoms longer before examination than male patients. As all patients considered in this study were minors, this could be due to treatment preference being given to males in the developing world, as suggested by Pearce et al (2001). The male preponderance present in the sex ratio (M: F = 1.3:1) was within the range previously presented in the studies from Nepal (Badhu et al, 2005; Saiju et al, 2006).

In this study, 11 patients (37%) presented with leukocoria as their only symptom. These patients experienced symptoms for an average of 1.9 ± 1.6 months before reporting to the TEC. When considered with patients that reported multiple symptoms, 24 patients (80%) reported with leukocoria. One patient (3.3%) reported with strabismus and a fungating mass each, and six patients (20%) reported with proptosis. These results contrast with previous studies of retinoblastoma in Nepal in which proptosis was the primary mode of presentation (40%) and fungating mass was a more common mode of presentation (33%) (Badhu et al, 2005; Saiju et al, 2006). Previous studies on retinoblastoma in Nepal also reported optic nerve infiltration rates of 48% and 40% (Badhu et al, 2005; Saiju et al, 2006). This study showed a slightly lower optic nerve infiltration rate of 38%.

Early detection of retinoblastoma, when leukocoria is the only symptom present, is associated with a more favorable prognosis (Abramson et al, 2003). Hence, when considered with previous retinoblastoma studies conducted in Nepal, the decreased lag time between the onset of symptoms and examination that was recorded in this study, as well as the increased proportion of patients who reported to the TEC with leukocoria, may reflect improvement in public awareness of retinoblastoma and/or retinoblastoma screening provided by primary healthcare workers.

All of the patients in this study underwent enucleation or exenteration. This rate is consistent with previous studies from Nepal (Badhu et al, 2005; Saiju et al, 2006) but it is higher than the 75% enucleation/exenteration rate in the United States (Shields et al, 1989). All eyes undergoing treatment in this study were either enucleated or exenterated because all tumors occupied greater than or equal to one-half of the retina.

**Conclusion**

This study found a significant association between region of residence and bilateral retinoblastoma in Nepal, but the cause behind this distribution could not be deduced. The decreased lag time between the onset of symptoms and examination that was recorded in this study, as well as the increased proportion of patients who reported to the TEC with leukocoria, may reflect improvement in public awareness of retinoblastoma and/or retinoblastoma screening provided by primary healthcare workers.

**Acknowledgments**

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Amozorrutia-Alegria V, Bravo-Ortiz JC, Vázquez-Viveros J, et al (2002). Epidemiological characteristics of


Original article

Successful treatment of lower eyelid epiblepharon by injection of botulinum toxin A in patients under two years of age

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Abstract

Introduction: Epiblepharon is characterized by a cutaneous horizontal fold adjacent to the lid margin. Some cases showed spontaneous resolution, others required surgical treatment. We propose a medical treatment with botulinum toxin type A (BTX-A). Objective: To provide clinical evidence of the usefulness of botulinum toxin type A (BTX-A) in patients with lower eyelid epiblepharon. Subjects and methods: This was a prospective, non-randomized, non-masked study. Patients with lower eyelid epiblepharon with corneal eyelash contact were included in the study. The scale proposed by Khwarg & Lee (1997) was used to assess the epiblepharon clinical evaluation. A single dose of 12.5 IU of BTX-A (Dysport®) was directly injected into the medial pre-tarsal orbicularis muscle region in the lower eyelid. Patients were evaluated before the injection and at 1, 4, 12 and 24 weeks after the injection. We performed descriptive statistics and Wilcoxon Signed Rank Test, comparing prior injection measurements to post injection measurements at the 24th week. A p < 0.05 was considered statistically significant. Each eye was separately analyzed. Results: Fourteen eyes of seven Hispanic patients were treated, five female and two male. The mean age was 8.4 months (4 - 14 months). The height of the skin-fold, the area of the cornea touched by the cilia and the symptoms score improved after the first week of BTX-A injection and remained so until the end of study (p < 0.05). No major complications were noted. Conclusion: The effect of a single 12.5 IU injection of BTX-A (Dysport®) into the medial orbicularis muscle portion in the lower eyelid epiblepharon patients successfully improves the clinical signs and symptoms.

Keywords: epiblepharon, botulinum toxin, lower eyelid

Introduction

Epiblepharon is characterized by a cutaneous horizontal fold adjacent to the lid margin, in which the underlying orbicularis muscle of the lid margin misdirects the lashes towards the eye causing ocular irritation and corneal erosion. The medial portion of the lower eyelid is most commonly affected and the condition is almost always bilateral. The prevalence reported in oriental infants varies from 46 to 52.5 % in children younger than 1 year (Khwarg & Lee, 1997).

The etiology of epiblepharon has not yet been established. Some authors have proposed that it is due to a congenital absence of the insertion of lower-eyelid retractors to the skin and orbicularis muscle or an insertion very close to the lid margin. Others support the combination of orbicularis muscle hypertrophy with an extra skin fold (Jordan, 1993).
It is well known that almost all cases are self-limited by the age of four or five years (Noda et al 1989). Meanwhile, a conservative treatment with eye lubricants is indicated for preventing ocular surface damage. Surgery is only indicated when there is significant corneal injury caused by the rubbing of the eyelashes and usually involves the removal of the skin and some pre-tarsal orbicularis muscle in the affected eyelid. Although the surgery is almost always successful and complications are unusual, under correction or recurrence rates range from 4.9 to 23 % and the potential risk of the surgical and anesthetic procedures should be considered (Sundar et al, 2010).

The main feature found in epiblepharon is the orbicularis muscle hypertrophy. BTX-A has been proven to weaken the muscle fibers in other eyelid conditions of similar patho-physiology. Steel et al (1997) have reported the improvement of involutive entropion with BTX-A. Christiansen et al (2004) used 5 BTX-A IU in a child with congenital entropion with successful results without major complications. Both authors applied the BTX-A in the orbicularis muscle of the affected eyelid in order to decrease the muscle contraction. There are five commercially available preparations of BTX-A: onabotulinumtoxinA (ona-BoNT/A; Botox®, Allergan, Inc, Irvine, CA), abobotulinumtoxinA (abo-BoNT/A; Dysport ® Ipsen LTD, Wrexham, UK), BTX-A (Lanzhou Institute, China), incobotulinumtoxin A (inco-BoNT/A; Xeomeen, Merz Pharmaceuticals, Frankfurt am Main, Germany) and Neuronox (nue-BoNT/A; MEDYTOX Inc., Cheonwon-gun, South Korea). Despite widespread clinical use, comparative dose ratios or conversion factors of BTX-A formulations remain controversial because they have been shown to have differences in efficacy and systemic effects (Kim et al 2013). Hxseel et al (2008) reported similar field effects at a dose equivalence of 2.5:1.0 IU (Dysport®:Botox®) for both muscle and sweat gland activity. Bearing in mind that both authors, Steel et al (1997) and Christiansen et al (2004), applied 5 IU of onabotulinumtoxinA (ona-BoNT/ A; Botox®, Allergan, Inc, Irvine, CA) and based on the reported conversion ratio observed by Hxseel et al (2008) between onabotulinumtoxinA (ona-BoNT/A; Botox®, Allergan, Inc, Irvine, CA), abobotulinumtoxinA (abo-BoNT/A; Dysport ® Ipsen LTD, Wrexham, UK), we decided to apply a single dose of 12.5 IU of Dysport ® BTX-A (corresponding to 5UI Botox®) into the medial region of the orbicularis muscle in the lower eyelid in patients with epiblepharon to ease symptoms and prevent ocular surface complications related to this disease.

Subjects and methods
Patients younger than two years of age with lower eyelid epiblepharon were included in the study. Patients with systemic diseases and any other eyelid malpositions, eyelid trauma or previous eyelid surgery were excluded; patients with an incomplete follow-up were eliminated from the study. Informed and signed consent was obtained from the child’s parents. In all patients the clinical evaluation of epiblepharon was made using the scale proposed by Khwarg and Lee (1997) in which three parameters are measured (Table 1): 1) height of skin fold, 2) the area of the cornea touched by the cilia and, 3) the area of corneal erosion using fluorescein staining (BioGlo Sterile Strips, CA, USA). Treatment consisted of injecting a single dose of 12.5 IU of BTX-A into the medial region of the hypertrophied orbicularis muscle about 3 - 4 mm below the eyelash margin of the affected lower eyelid. Dysport ® is provided in a glass vial containing 500 IU, which was diluted with 2 ml of 0.9% saline solution resulting in a concentration of 25 units in 0.1ml. All the procedures were performed at the office using topical tetracaine hydrochloride 0.5 % eye drops as ocular surface anesthetic (Ponti-Ofteno, Sophia, México) with appropriate child immobilization. The puncture site was cleaned by making a smooth circular pass over the site with a 70 % alcohol pad allowing the skin to dry before proceeding. Each injection consisted of 12.5 IU (0.05 ml) of diluted BTX-A preparation applied directly into the affected lower eyelid using a syringe with a 31-G insulin needle (Plastipak, Edo. De...
México, Mexico). All patients received BTX-A from the same preparation vial, and only one surgeon (ANC) applied the injection in all cases. A 0.2 % tobramycin eye ointment (Trazil-ofteño, Laboratorios Sophia, Mexico) was applied in a single dose after the injection.

After the BTX-A injection, patients were monitored at 1, 4, 12 and 24 weeks. At each visit, ophthalmological evaluation of the grade of epiblepharon was done according to the Kwarg and Lee (1997) scale. The clinical epiblepharon assessment was made by the same surgeon (CYC).

Each eye was evaluated separately and the collected data was analyzed using the Wilcoxon Signed Rank Test, comparing measurements of the skin fold height, the corneal area touched by the cilia (corneal touch) and the corneal erosion area prior to the injection to the with the same variables measured at the 24th week after the injection. A \( p < 0.05 \) was considered statistically significant. SPSS/PC+ software (version 17 SPSS Inc., Chicago, IL, and U.S.A.) was used for the statistical analysis.

The study was approved by the Internal Review Board of our institution and the tenets of the Declaration of Helsinki were followed.

Results

Fourteen eyelids of seven patients, all of them Hispanic (2 male and 5 female), with a mean age of 8.4 months (range 4 - 14 months) were included in the study. The seven patients completed the follow-up period and in all cases the epiblepharon had affected both the lower eyelids. The results of Kwarg & Lee scale are summarized in Table 1. The prior-injection skin fold height measurements showed that most of the patients were in class III, RE 4 eyelids, 57 %, LE 5 eyelids 71 %; at the end of the study, most of the RE and LE showed improvement to class II, 4 eyelids, 57 %, and 5 eyelids, 43 % respectively. The prior-injection measurements of the corneal area touched by the cilia were mostly categorized as class III, 4 RE, 57 % and 5 LE, 71 %. When comparing prior injections measurements to the 24th week measurements of these two categories using the Wilcoxon Signed Rank Test, statistical differences were found in both (\( p < 0.05 \)). In our study, only one patient presented with corneal erosion at the beginning of the study, classified within class II in both the eyelids. This patient showed an improvement to class I during the first week after treatment, and remained thus until the end of the study. We noted that most of the patients began showing clinical improvement in both the height fold skin and corneal touch area from the first week after injection, which continued and remained stable until the end of the study (Figures 1 and 2). All the injections were successfully applied in the office without the need for any sedative maneuver and only self-limited eyelid hematomas at the site of injection were seen. We did not observe any disturbance in ocular motility, secondary ectropion or any other complication.

The numbers, in the tables, represents the number of eyelids included. As we can see, at the 24th week, most patients moved toward class I of each measurement, and statistical differences were found in the skin fold height and corneal touch when comparing prior injection measurements to measurements at 24th week after the injection (*).

Table 1

<table>
<thead>
<tr>
<th>Class ++</th>
<th>PreTx</th>
<th>24 wks*</th>
<th>PreTx</th>
<th>24 wks*</th>
<th>PreTx</th>
<th>24 wks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RE</td>
<td>LE</td>
<td>RE</td>
<td>LE</td>
<td>RE</td>
<td>LE</td>
</tr>
<tr>
<td>I</td>
<td>0 0</td>
<td>2 3</td>
<td>1 1</td>
<td>5 5</td>
<td>6 6</td>
<td>7 7</td>
</tr>
<tr>
<td>II</td>
<td>2 1</td>
<td>4 3</td>
<td>2 1</td>
<td>2 2</td>
<td>1 1</td>
<td>0 0</td>
</tr>
<tr>
<td>III</td>
<td>4 5</td>
<td>1 1</td>
<td>4 5</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>IV</td>
<td>1 1</td>
<td>0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>7 7</td>
<td>7 7</td>
<td>7 7</td>
<td>7 7</td>
<td>7 7</td>
<td>7 7</td>
</tr>
</tbody>
</table>

++ Morphologic eyelid description and classification.- (Khwarg & Lee 1997)

RE \( p = 0.004 \), LE \( p = 0.014 \). 

\( n = 14 \) eyelids. RE = right eye, LE = left eye
Height of skin fold scale
Class I - The highest line of skin fold is located below the lower eyelid margin.
Class II - The skin fold is just below or on the lower eyelid margin, without concealment of the eyelid margin.
Class III - The skin fold is above the lower eyelid margin with concealment of less than the medial third of the eyelid margin.
Class IV - The skin fold is above the lower eyelid margin with concealment of more than the medial one third of the eyelid margin.

Corneal touch scale:
Class I - Inverted cilia touching less than medial one third of the cornea.
Class II - Inverted cilia touching less than medial two thirds of the cornea.
Class III - Inverted cilia touching more than two thirds of the cornea.

Corneal erosion scale:
Class I - No corneal erosion.
Class II - Less than the medial one third of the cornea is eroded.
Class III - More than medial one third of the cornea is eroded.

Discussion
Epiblepharon is not an uncommon disease seen in our practice. This entity is self-limited in most cases at around two years of age. Within this period, the patient usually presents irritative signs and symptoms due to the ocular surface eyelash contact. Symptomatic treatment with ocular lubricants is usually indicated. When the symptoms persist or corneal complications occur despite the use of lubricants, surgical treatment is indicated. Although the surgical treatment is highly successful, results could sometimes be unpredictable and complications related to the surgical and anesthetic procedures may arise.

Searching for an alternative procedure to surgery, Naik et al (2010) treated a 4-month-old infant with epiblepharon with medial eyelashes touching with an injection of 0.2 ml of hyaluronic acid gel (Juvederm Ultra) in the sub-orbicular plane in the valley above the abnormal skin fold. He observed an immediate out-turning of the eyelid, which persisted until the fourth month.

In this study, we also propose a non-surgical treatment to improve the clinical signs of patients with epiblepharon by applying 12.5 IU of BTX-A directly to the hypertrophied orbicularis muscle.

We demonstrated in our epiblepharon patients that BTX-A improves the eyelid skin fold, the area of corneal touch by cilia and corneal erosion area. These changes were seen since the first week of application and remained during the whole study period. This will ultimately impact on ocular symptoms, the appearance of ocular complications, such as conjunctival squamous metaplasia, corneal erosion and ulceration.

One of the major advantages of this procedure is its simplicity, and that it is a non-invasive treatment that can be performed by any ophthalmologist. The treatment is reversible due to the period of action of BTX-A which is of six months on average. Most epiblepharon patients will have a spontaneous resolution within the first two years of life. With the BTX-A application we are providing the patient with a symptom-free period before the spontaneous resolution appears. Deka et al (2011) used BTX-A for the treatment of lower lid entropion. In his study, three children with congenital entropion were included. The author stated that botulinum toxin is a safe and effective procedure for correction of
senile entropion and some cases of congenital entropion, and no complications or side effects of this treatment were noticed. We also did not find any complications related to diffusion of the toxin to the adjacent tissues, especially disturbances in eye motility or lower eyelid misdirection.

**Conclusion**
The present study demonstrates that a single dose of 12.5 IU of BTX-A, abobotulinumtoxin A (abo-BoNT/A; Dysport® Ipsen LTD, Wrexham, UK) injected into the medial region of the hypertrophied orbicularis muscle of the affected inferior eyelid is a safe procedure that improves the clinical eyelid signs of epiblepharon and eventually will alleviate ocular symptoms and will prevent ocular surface complications in patients with lower eyelid epiblepharon.

**References**


Source of support: nil. Conflict of interest: none
Surgical outcomes of minimally invasive vitrectomy surgery in Eales’ disease

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Abstract

Introduction: The results of surgical outcomes of 20 gauge pars plana vitrectomy in Eales’ disease are available in the scientific literature. However, all these studies have been done using the 20 gauge vitrectomy systems and most studies have been conducted in a retrospective manner. Objective: To evaluate the outcomes and safety of 23 gauge vitrectomy in complications of Eales’ disease. Materials and methods: Study design: Consecutive interventional case series. Participants: Seventy-six eyes of 72 non-consecutive patients undergoing 23-gauge vitrectomy for complications of Eales’ disease were enrolled. The participants were followed up for a minimum of one year. Intervention: The participants underwent a complete demographic, medical and ophthalmic evaluation. A 23-gauge vitrectomy was performed. Endotamponade was used when necessary. Perioperative and postoperative events were recorded. Primary outcome measures were visual acuity and complications arising due to surgery. Results: Indication for surgery was non-clearing vitreous hemorrhage in 89.4% (68/76) and secondary retinal detachment in 10.6% (8). Visual acuity improved from Log Mar 1.80 ± 0.19 units preoperatively to Log Mar 0.47±0.59. Best-corrected visual acuity equivalent to Snellen 6/9 was achieved in 77.6% of eyes. Surgical failure was seen in 6.5% cases. Four cases were lost due to progression to neovascular glaucoma and 1 case was lost to severe residual retinal detachment. Iatrogenic portsid retinal breaks occurred in 3.9% (3), post-vitrectomy retinal detachment 2.6% (2), hypotony 1.3% (1) and cataract in 38.1% (28) cases. Conclusion: 23-gauge sutureless vitrectomy in patients with Eales’ disease is a safe and effective technique with acceptable level of risk and complications. Keywords: Eales’ disease, retinal vasculitis, sutureless vitrectomy, 23 gauge vitrectomy, vitreous hemorrhage

Introduction

Eales’ disease was first described in 1882 by a British ophthalmologist, Henry Eales (Eales H, 1882, 1880). The disease, now described mostly from the developing nations is an idiopathic phlebitis culminating often in peripheral retinal neovascularization and multiple episodes of vitreous hemorrhage and tractional retinal detachment (Atmaca LS 1993; Das T 1994, Renie WA 1983). The management comprises of systemic steroids for active vasculitis, scatter laser photocoagulation for retinal neovascularization and pars plana vitrectomy for non-clearing vitreous hemorrhage and tractional retinal detachment involving or threatening the macula (Das T 1994).
Ever since the advent of pars plana vitrectomy, the development of vitrectomy systems has been directed towards ever smaller and more efficient instruments that may help in reducing the surgical time and hastening patient recovery. Since the first introduction of 23-gauge vitrectomy system by Singh et al (Singh S et al 1996) and introduction into clinical use by Eckardt et al (Eckardt C, 2005), the efficacy and safety of the system has been established for various posterior segment disorders. The results of surgical outcomes of 20 gauge pars plana vitrectomy in Eales’ disease are available in the scientific literature. However, all these studies have been done using the 20 gauge vitrectomy systems and most studies have been conducted in a retrospective manner (Treister G et al, 1977; Smiddy WE et al, 1988; Shamnugam MP et al, 1998; Badrinath SS et al, 1999; Kumar A et al 2000; El-Asrar AM et al 2002; Majji AB et al 2006; Shukla D et al 2008). We hereby undertook this prospective study with the primary objective to establish the safety and evaluate the outcomes of 23-gauge vitrectomy in cases of Eales’ disease.

Materials and methods
The study enrolled 76 eyes of 72 in patients with the diagnosis of Eales’ disease at a tertiary care centre over a period of one year from February 2009 to January 2010. The diagnosis of Eales’ disease was made on the basis of idiopathic retinal phlebitis in the fellow eye. The indications of surgery were nonclearing vitreous hemorrhage of minimum 2 months with visual acuity < 6/12, tractional retinal detachment threatening or involving the macula, secondary rhegmatogenous retinal detachment.

Patients with intermediate uveitis, choroiditis or coexisting anterior uveitis were excluded. Ocular inflammation secondary to infectious or autoimmune or other inflammatory causes as diagnosed on history, clinical examination or investigation were excluded. Other causes of proliferative retinal vasculopathies such as diabetic retinopathy, sickle cell disease, familial exudative vitreoretinopathy and retinopathy of prematurity were excluded. Those patients who refused to give an informed consent for the study or could not complete one-year follow were excluded from the study. Ophthalmic examination included recording best-corrected visual acuity, anterior segment examination, Goldmann applanation tonometry and dilated fundoscopy. B scan ultrasonography was done in cases where media haze obviated fundus evaluation. Degree of posterior vitreous detachment, rhegmatogenous retinal detachment, points of attachment of posterior hyaloid to the retina and tractional retinal detachment involving the macula were noted.

Patient workup
On enrollment demographic, medical and ophthalmic evaluation was performed. Demographic data included age, gender, ethnic origin, occupation and Koch’s illness in close contacts. Medical evaluation was directed to rule out tuberculosis, sarcoidosis, Behcet’s disease, and retroviral disease, syphilis and collagen vascular diseases. Systemic evaluation in all cases included chest X ray, Mantoux test, complete blood count, enzyme-linked immunosorbent assay for human immunodeficiency virus and treponemal antibody test and examination for lymphadenopathy.

Surgical procedure
After explaining the surgical procedure and obtaining an informed written consent, risks and postoperative care, the patients underwent 23 gauge pars plana vitrectomy with endophotoacoagulation under peribulbar anesthesia. The surgery was performed using the Accurus vitrectomy system (Alcon, Hünenberg, Switzerland) using the ACCURUS Surgical System 23-gauge TOTAL PLUS Pak (Alcon, Hünenberg, Switzerland). In all patients the vitrectomy was completed with induction of posterior vitreous detachment and shaving of the vitreous. Neovascularization at the disc (NVD) and elsewhere (NVE) were segmented and then the NVE was surrounded by barrage laser. Endophotoacoagulation was done in area distal to the NVE. In case NVD was present panretinal
photocoagulation was done. After completion of vitrectomy the globe was left filled with air by performing a complete air-fluid exchange. Tamponade agent in the form of non-expansile gas or oil was used at the discretion of the surgeon. The postoperative treatment regime included topical antibiotics eye drops (moxifloxacin hydrochloride; 0.5%, 4 times daily for 14 days [Alcon laboratories, Texas, USA]), topical steroid drops (prednisolone acetate; 1%, 4 times daily for 21 days [Allergan India Ltd., India]) and short acting cycloplegics (tropicamide; 1%, 3 times daily [Optho Remedies, India]). The patients were seen on day 1, 1 week, 4 weeks and then 3 monthly and the final parameters and events were recorded at the end of one year. During follow up best corrected visual acuity, development of cataract or other factor obviating return of potential vision and complications were noted and treated. Optical coherence tomography was performed in cases suspected to have cystoid macular edema. Fundus fluorescein angiography was done if macular ischemia was suspected as a cause of no improvement in vision. The study was approved by the Institutional review board and adhered to the tenets of the Declaration of Helsinki.

**Statistical analysis**

The data was tabulated using Microsoft Excel 2007 and analyzed using the SPSS version 11. Descriptive analysis was employed and results were expressed using mean and distribution of proportions.

**Results**

**Baseline parameters**

The study comprised of 76 eyes of 72 patients. All the patients were males. The mean age was 26.4 ±6.6 years The mean duration of symptoms was 3.7 ±2.4 months (range 1-18 months). The mean preoperative visual acuity was 1.80 ± 0.19 LogMAR units.

The indication for surgery was nonclearing vitreous hemorrhage in 89.4 % (68/76) cases. Secondary retinal detachment (tractional retinal detachment involving or threatening the macula, combined tractional and rhegmatogenous retinal detachment and secondary rhegmatogenous retinal detachment) was the indication of surgery in 10.6% (8/76) cases. Intra-operatively, 51.3% (39/76) participants had neo-vascularization of the disc (NVD), while 67% (51/76) had neovascularization elsewhere (NVE). Nearly 30% of these eyes had multiple NVE’s. Only 10.6% had a complete posterior vitreous detachment (PVD) and the remaining 89.4% had partial PVD. In 17% of the eyes some form of endotamponade was used (6.5% and 10.5% non-expansile gas and silicon oil respectively). Peroperatively old laser scar marks were noted in 13.15% (10).

**Surgical results**

The mean preoperative best-corrected visual acuity was 1.80 ± 0.19 units. (equivalent to 1/60 snellen acuity). The mean post-operative uncorrected visual acuity was Log Mar 0.47±0.59 (equivalent to mean of 6/18 - Snellen acuity). Uncorrected visual acuity of Snellen 6/9 or better was achieved in 52.3% of the cases. The postoperative mean best corrected visual acuity was 0.42 ± 0.61. Best corrected visual acuity equivalent to Snellen 6/9 was achieved in 77.6% (59/76) cases. A small proportion of cases, 5.2% (4/76) patients did not gain vision after surgery and 1.3% (1/76) patients went to Pl absent vision postoperatively. Of the patients not achieving best corrected visual acuity to Snellen 6/9, the following causes were incriminated: Neovascular glaucoma 4/17, unrelieved macular tractional retinal detachment in 2/17, photoreceptor degeneration 3/17, cataract 4/17, resolved cystoid macular edema in 4/17 epiretinal membrane 3/17 eyes. In three cases the cause of visual loss was pre-existing full thickness macular hole, anisometropic amblyopia and macular ischemia respectively. In many cases more than one cause was incriminated as the reason for non-improvement in visual acuity. The complications encountered in the intraoperative - postoperative period have been summarized in Table-1.
Table 1: Surgical complications encountered in patients undergoing minimally invasive vitrectomy for Eales’ disease

<table>
<thead>
<tr>
<th>Event</th>
<th>Percentage (n/N)</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior subcapsular cataract</td>
<td>38.1% (28)</td>
<td>Cataract surgery done in 18 cases. Lensectomy done in lens touch with secondary intraocular lens implantation at 3 months.</td>
</tr>
<tr>
<td>Intraoperative lens touch</td>
<td>1.3% (1)</td>
<td></td>
</tr>
<tr>
<td>Early dispersed postoperative rebleed</td>
<td>9.2% (7)</td>
<td>5 cases media clear at week 1, in 2 cases lavage done at end of month 1</td>
</tr>
<tr>
<td>Iatrogenic retinal break</td>
<td>6.5% (5)</td>
<td>3 portside dialysis, cryopexy done; 2 breaks at the base of tractional detachment, endotamponade used</td>
</tr>
<tr>
<td>Postvitrectomy retinal detachment</td>
<td>2.6% (2)</td>
<td>1 case managed with scleral buckling combined with pneumatic retinopexy.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Case 2 managed silicon oil endotamponade</td>
</tr>
<tr>
<td>Postoperative hyptonoy</td>
<td>1.3% (1)</td>
<td>Manage with intermittent pressure patch for 48 hours and oral steroids ; resolved in 48 hours</td>
</tr>
<tr>
<td>On table wound leak</td>
<td>6.5% (4)</td>
<td>Transconjunctival suturing of the port</td>
</tr>
<tr>
<td>Neovascular glaucoma</td>
<td>6.5% (4)</td>
<td>Anti VEGF therapy and Anterior retinal Cryopexy</td>
</tr>
</tbody>
</table>

Discussion


However, sutureless vitrectomy has also been criticized for having high incidence of port side vitreous prolapse, retinal break formation, sclerotomy site leakage, hypotony and endophthalmitis (Fujii GY et al 2002; Lakhanpal RR et al 2005; Gupta OP et al 2007, Scartozzi R et al 2007; Magosso LM et al 2007; Taban M 2006; Taylor SR and Aylward GW 2005).

In spite of established safety and efficacy data of sutureless vitrectomy in various vitreoretinal diseases (Acar N et al 2008; Altan T et al 2008; Altan T et al 2009; Chieh JJ et al 2009, Erakgun T et al 2009; Gonzales CR et al 2009 and 2006, Kadonosono K et al 2006, Kusuhara S et al 2008; Lopez-Guajardo L et al 2008; Ma J et al 2008) it was essential to ascertain the same in cases of Eales’ disease due to its distinctive surgical minutiae. An important core issue pertaining to Eales’ vitrectomy is that the peripheral retinal neovascularization (NVE) are sites for potential vitreoretinal traction and peripheral retinal break formation. In the setting of sutureless vitreoretinal intervention the problem may be compounded by the inability to remove peripheral vitreous skirt and lack of exoplant support. In our series, we employed 23 gauge vitrectomy instruments using standard sclerotomy placements and the surgery could be completed in all cases. No case required conversion to 20-gauge surgery. However 5.2% (4) needed a one-transconjuctival suture to overcome leakage from sclerotomy.

The visual results were comparable to the results achieved in most of the studies done employing the 20-gauge technique. The mean best-corrected visual
acuity in the present study was equivalent to 6/18 on the Snellen chart, with almost three-fourth of the eyes achieving a vision of 6/9 or better. Shukla et al (2008) have reported mean visual acuity of 6/24 with BCVA>6/18 in 60.6% of the cases. Kumar et al (2000) reported excellent visual outcome in Eales’ disease (VA>6/18 in 85%), whereas El-Asrar and Al-Kharashi (2002) reported acuity VA>6/12 in a modest 26%. Majji et al (2006) had final acuity VA > 20/50 in 30% cases. The results of various studies done in the past have been summarized in Table 2.

Table 2: Brief review of studies evaluating outcomes of standard 20G vitrectomy in Eales’ disease

<table>
<thead>
<tr>
<th>Authors</th>
<th>Year of work</th>
<th>No. of eyes</th>
<th>Instrument Gauge</th>
<th>Pre and peroperative characteristics</th>
<th>Extent of posterior Vitreous detachment</th>
<th>Visual results</th>
<th>Adverse outcomes</th>
<th>Follow up period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treister G, Machemer R</td>
<td>1977</td>
<td>7</td>
<td>17 G</td>
<td>Vitreous hemorrhage(5) , Tractional detachment(2)</td>
<td>Not mentioned</td>
<td>57.1% (4/7) visual acuity ≥ 6/18</td>
<td>1 eye to NLP and 2 Neovascular glaucoma</td>
<td>6-15 months</td>
</tr>
<tr>
<td>Shanmugan MP et al</td>
<td>1998</td>
<td>64</td>
<td>20 G</td>
<td>Not available</td>
<td>Not available</td>
<td>71.8% visual acuity ≥ 6/60</td>
<td>7.8% recurrent vitreous bleed</td>
<td>60 months</td>
</tr>
<tr>
<td>Badrinath et al</td>
<td>1999</td>
<td>18</td>
<td>20 G</td>
<td>Vitreous hemorrhage (9) , Tractional detachment (7) , Rhegmatogenous detachment (2)</td>
<td>Incomplete in all cases Single vitreoretinal adhesion(1), Multiple adhesions(15)</td>
<td>Not mentioned</td>
<td>Not mentioned</td>
<td>Not mentioned</td>
</tr>
<tr>
<td>Kumar et al</td>
<td>2000</td>
<td>40</td>
<td>20 G</td>
<td>Vitreous hemorrhage(40)</td>
<td>Complete (85%)</td>
<td>85% (34/40) visual acuity ≥ 6/18</td>
<td>Macular pucker 25% (10/40), Macular edema(22.5 %)</td>
<td>Minimu m 3 months</td>
</tr>
<tr>
<td>El Asrar et al</td>
<td>2002</td>
<td>15</td>
<td>20 G</td>
<td>Vitreous Hemorrhage (11), Tractional detachment (4)</td>
<td>Not available</td>
<td>93.3% (14/15) ≥ 6/60</td>
<td>Not available</td>
<td>Not available</td>
</tr>
<tr>
<td>Majji AB et al</td>
<td>2006</td>
<td>18</td>
<td>20 G</td>
<td>Epiretinal membranes (18)</td>
<td>Incomplete</td>
<td>30% ≥ 6/15</td>
<td>28% legally blind</td>
<td>Not available</td>
</tr>
<tr>
<td>Shukla D et al</td>
<td>2008</td>
<td>71</td>
<td>20 G</td>
<td>69% vitreous hemorrhage , 31% Secondary Retinal detachment</td>
<td>Partial or no PVD in 60.8%</td>
<td>60.6% (43/71) ≥ 6/18</td>
<td>(15.5%) 11/71 Surgical failures</td>
<td>8-14 months</td>
</tr>
<tr>
<td>Our Study</td>
<td>2010</td>
<td>76</td>
<td>23 G</td>
<td>89.4% vitreous haemorrhage 10.6% secondary retinal detachment</td>
<td>89.4% partial or no PVD</td>
<td>77.6% (59/71) ≥ 6/9</td>
<td>6.5% (5) surgical failures</td>
<td>Minimu m one year followu p</td>
</tr>
</tbody>
</table>

The difference in the results could be due to the difference in the baseline characteristics (choosing simple vitreous hemorrhage over complex tractional detachments). Presence of incomplete posterior vitreous detachment has also been cited as a poor prognostic factor (Shukla D, 2008), which we do not feel evident in our study since only 10% patients had complete PVD and we had a low surgical failure rate of 6.5% compared to 15%-42% (Treister G et al 1977; Majji AB et al 2006; Shukla D et al 2008) reported in the past.
Postoperative hypotony was seen in 1/76 (1.3%) eyes in our series, which resolved in 48 hours. No case developed postoperative choroidal detachment, bleb formation or postoperative endophthalmitis. While postoperative hypotony is almost unknown in 20 gauge vitrectomy, the rates were comparable with other series employing 23 gauge technique. Lee DY et al (2011) reported hypotony in 0.7% of eyes undergoing combined 23-gauge sutureless vitrectomy, clear corneal phacoemulsification, and intraocular lens implantation in patients with proliferative diabetic retinopathy. Other studies have reported rates between 3% - 22.9%. (Mateo-Montoya A et al 2011; Park DH et al 2010; Haas A et al 2010). In a comparative study of the safety and efficacy of 20 - and 23-gauge pars plana vitrectomy (PPV) for the management of primary rhegmatogenous retinal detachment (RD), Albrieux M et al reported portside break formation in 8.5% of cases undergoing 23 gauge intervention compared to none in 20 gauge group (Albrieux M et al, 2011).

Contrary to this, Issa SA et al (2011) observed that 23-gauge transconjunctival vitrectomy surgery was associated with a lower rate of retinal break formation than 20 gauge vitrectomy for proliferative diabetic retinopathy (5 % vs 14%).

The findings of Nakano T et al (2011) support those of Issa SA et al. They reported an incidence of 1.1% in 23 G group versus 8.5% in 20 G group, in cases undergoing vitrectomy for macular diseases. Rizzo S (2010) found no statistical difference in the incidence of RD, 1.7% after sutureless vitrectomy and 1.2% after conventional 20-gauge vitrectomy.

In our study, 6.5% (5) developed portside events. Of these, 3 were portside dialysis and the 2 portside events were delayed postoperative retinal breaks, presenting at 11 and 16 weeks respectively. The breaks were formed at the base of peripheral NVE, which were located in the sub-incisional area and had developed vitreous traction due to plugging of the sclerotomy port by the vitreous. Vitreous lavage for rebleed was done in 2.6% (2/76) cases, which is comparable to a rate of 7.4% in a recent study (Shanmugam MP et al 1998).

We had a high incidence of cataract (36.8%) that was comparable to similar studies (24%-45%) done in the past (Shukla D et al 2008). We had a surgical failure rate of 6.5% (5/76). Four cases due to neovascular glaucoma and 1 case due to severe residual retinal detachment.

**Conclusion**

We conclude that 23 gauge sutureless vitrectomy in patients with Eales’ disease is a safe and effective technique with acceptable level of risk and complications.

**References**


Source of support: nil. Conflict of interest: none
Optical coherence tomography in diabetic macular edema: patterns and related risk factors

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Abstract

Introduction: Diabetic Macular Edema (DME) is an important cause of vision loss in diabetic retinopathy. Optical Coherence Tomography (OCT) is a non-invasive modality that produces high-resolution images of retinal layers. Objective: To evaluate the prevalence of DME patterns and their association with risk factors and visual acuity. Materials and Methods: In this cross-sectional study, type 2 diabetics with macular edema referred to our center during a ten-month period underwent OCT. Patients with macular edema due to causes other than diabetes and with OCT images of improper quality were excluded from the study. Four distinct patterns were found in the OCT images. A questionnaire including age, sex, duration of diabetes, serum TG and cholesterol, HbA1c, BMI and visual acuity, as well as the findings of OCT images were filled for the subjects. Results: Eighty-six eyes from 46 patients were evaluated. The most and the least common patterns were sponge-like retinal swelling (SLRS) and posterior hyaloidal traction (PHT) found in 64.0% and 5.8% of the subjects, respectively. A sub-retinal fluid pattern was more common in males (p=0.011) and in patients with serum TG > 200mg/dl (p=0.037). There were significant associations between central foveal (r=0.45, p<0.001), nasal (r=0.35, p=0.001) and temporal (r=0.32, p=0.003) thicknesses with visual acuity. Moreover, the highest thickness (462.4±119.2µm) and also the worst visual acuity (1.0±0.5logMAR) pertained to the cystoid macular edema (CME) pattern. Conclusion: Our study showed that the most common OCT pattern of DME is the sponge-like retinal swelling, while posterior hyaloidal traction has the lowest prevalence. A higher foveal thickness and a lower visual acuity are seen in the CME pattern.

Keywords: optical coherence tomography, diabetic macular edema, OCT pattern, diabetic retinopathy
blindness in patients with diabetic retinopathy (Fong DS et al, 1999). According to the Early Treatment of Diabetic Retinopathy Study (ETDRS report number 7, 1991), Clinically Significant Macular Edema (CSME) is defined as observation of retinal thickening within 500µm of the center of the macula or if a zone of one-disc area size of retinal thickness is seen within one-disc diameter of the center of the macula.

Traditional methods for evaluating macular edema such as stereo-fundus photography and contact and non-contact fundus biomicroscopy are not sensitive enough to determine the details of the involved area. Optical Coherence Tomography (OCT) is a non-invasive modality which produces cross-sectional or three-dimensional, high-resolution images of the retinal layers and quantitative assessment of retinal thickness and other features of macular edema which correlate well with retinal histology as viewed by light microscopy especially by introducing the spectral domain (SD) OCT (Hee MR et al, 1998; Otani T et al, 1999; Yamamoto S et al, 2001; Buabbud JC et al, 2010). OCT has been widely used as a valuable tool for diagnosis and management of DME during the past two decades (Hee MR et al, 1998; Koozekanani D et al, 2000; Browning DJ et al, 2008).

Based on the findings of OCT, various morphologic patterns have been suggested for categorization of DME (Ozdek SC et al, 2005; Kim BY et al, 2006; Soliman W et al, 2007). In this study, we evaluated the prevalence of OCT patterns of DME as well as the association of these patterns with the risk factors of DME based on the OCT findings. We also assessed the relationship between these patterns with visual acuity by measuring the central, nasal and temporal foveal thicknesses as well as detecting the central and total foveal volumes.

**Materials and methods**

In this cross-sectional study, type 2 diabetic patients with macular edema referred to Yazd Diabetes Research Center (Yazd, Iran) from January 2011 to October 2012 were enrolled. The study was approved by the medical ethics committee of Shahid Sadoughi University of Medical Sciences. After interviewing the subjects and describing the study to them, written consent was taken from all the participants. The OCT scans were done by a highly skilled ocular photographer using SPECTRALIS HRA+OCT (Heidelberg Engineering, Heidelberg, Germany) with 3.9µm axial resolution and 40,000 A-scans/second. Patients with macular edema due to causes other than diabetes were excluded from the study. In addition, cases were excluded if the quality of the OCT images was not good.

According to the structural appearance of OCT imaging and classifications in previous studies (Alkuraya H et al, 2005; Kim BY et al, 2006), we classified these images into four distinct patterns. Sponge-like retinal swelling (SLRS) was defined as an increase in retinal thickening and a reduction in the intra-retinal reflectivity. Cystoid macular edema (CME) was described as cystoid-like spaces surrounded by a highly reflective septa in the macular area. Subretinal Fluid (SRF) was defined as a dome-like dark space under a highly reflective area. Finally, posterior hyaloidal traction (PHT) was described as a highly reflective layer from the inner retinal surface. Some of the patients had more than one pattern. The patients’ visual acuities were achieved by Snellen chart and converted to logMAR (logarithm of the minimum angle of resolution).

A questionnaire including age, sex, duration of diabetes, serum TG and cholesterol, HbA1c level and BMI as well as the findings of OCT images was filled for all the subjects.

**Statistics:** The data was analyzed using SPSS version 18. P-value ≤ 0.05 was considered significant.

**Results**

Eighty-six eyes from 46 type-2 diabetic patients (20 men and 26 women) with macular edema were evaluated. The mean age of the patients was 61.4±9.6 years with a mean duration of disease of 12.2±6.1 years. Hypertension was found in 20
(43.5%) subjects. The patients were under either oral antidiabetic drugs (n=31, 67.4%), insulin (n=10, 21.7%) or both (n=5, 10.9%). Twenty-two cases (47.8%) had HbA1c levels less than 9% and 24 cases had levels above 9%. Serum cholesterol levels below and above 150 mg/dl was seen in 14 (30.4%) and 32 (69.6%) patients, respectively. A high serum level of triglyceride (TG ≥ 200 mg/dl) was found in 24 (52.2%) and lower levels (TG<200 mg/dl) were found in 22 (47.8%) subjects.

Based on the findings in the OCT images of the retinas, four patterns were identified (Table 1).

Table 1: Prevalence of OCT patterns of DME

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Number(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLRS</td>
<td>35 (64.0)</td>
</tr>
<tr>
<td>SRF</td>
<td>41 (47.7)</td>
</tr>
<tr>
<td>CME</td>
<td>24 (27.9)</td>
</tr>
<tr>
<td>PHT</td>
<td>5 (5.8)</td>
</tr>
</tbody>
</table>

OCT - Ocular coherence tomography; DME - Diabetic macular edema; SLRS - Sponge-like retinal swelling; SRF - Subretinal fluid; CME - Cystoid macular edema; PHT - Posterior hyaloidal traction.

Our results showed that there is an association between the prevalence of sub-retinal fluid pattern with age ≥ 60 years and HbA1c levels, but they were not statistically significant (p=0.054, 0.086 respectively). Also, this pattern was found in males more than in females (p=0.011). Also, there was a significant relationship between the mean serum levels of TG and the presence of SRF pattern (p=0.037). Similar associations were not found for other patterns and the risk factors.

The mean central foveal thickness and total foveal volume were 361.3±55.4µm and 400.3 ± 108.4mm³, respectively. The foveal thickness at the nasal and temporal regions was 353.2±55.4µm and 361.3±55.4µm, correspondingly.

Table 2 demonstrates the central foveal thickness, central foveal volume and mean visual acuity according to the patterns of macular edema found in the patients.

Table 2. Results of different parameters according to the OCT patterns of DME.

<table>
<thead>
<tr>
<th>Pattern</th>
<th>SLRS</th>
<th>SRF</th>
<th>CME</th>
<th>PHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central foveal thickness (µm)</td>
<td>389.8±104.0</td>
<td>421.2±118.9</td>
<td>462.4±119.2</td>
<td>450.8±86.0</td>
</tr>
<tr>
<td>Central foveal volume (mm³)</td>
<td>0.3±0.1</td>
<td>0.4±0.1</td>
<td>0.4±0.1</td>
<td>0.4±0.1</td>
</tr>
<tr>
<td>Visual acuity (logMAR)</td>
<td>0.8±0.5</td>
<td>0.9±0.5</td>
<td>1.0±0.5</td>
<td>0.8±0.5</td>
</tr>
</tbody>
</table>

Discussion

OCT is a non-invasive, rapid and repeatable method for obtaining high resolution cross-sectional images of the retina. In our study, four patterns of macular edema were found, based on the OCT images, and the most prevalent pattern was SLRS (64.0%) while the PHT pattern had the least prevalence (5.8%). In the Alkuraya H et al study (1995), the SLRS pattern was the most common (45.4%), followed by the CME (29.0%), serous retinal detachment (21.8%) and vitreofoveal traction (3.6%) patterns. Similarly, in a survey done by Otani T et al (1999), SLRS was the most frequent pattern found in 88% of the patients.

In our study, the sub-retinal fluid (SRF) pattern had strong associations between male gender (p=0.011) and mean serum TG (p=0.037). Although the p-values for the association of this pattern with HbA1c
(p=0.084) and age ≥ 60 years (p=0.054) were not statistically significant, it seems that they would become significant with a similar study with a greater sample size.

At the time of writing this paper, we found no study which evaluates the relationship between the OCT patterns of macular edema with the risk factors.

Some studies have assessed the association of visual acuity with retinal thickness (Goebel W et al, 2002; Catier et al, 2005; Hussain A et al, 2005). Also, the association between the OCT patterns and visual acuity has been cited in some investigations. Our study showed that the highest thickness (462.4±119.2 µm) and also the worst visual acuity (1.0±0.5 logMAR) pertain to the CME pattern. In the Alkuraya H et al (1995) study, serous retinal detachment and vitreofoveal traction patterns were accompanied by a higher central retinal thickness and a worse visual acuity. In the Yamamoto S et al (2001) study, the CME pattern was associated with a lower visual acuity. Also, in another study (Kim et al, 2006), the CME and PHT without tractional retinal detachment were related to a worse visual acuity.

**Conclusion**

Our study showed that the most common OCT pattern of DME is SLRS, while PHT has the lowest prevalence. Moreover, this study showed that a higher foveal thickness is associated with a lower visual acuity and the worst visual acuity was seen in patients with the CME pattern. There was a significant association between the SRF pattern and some risk factors.

**Acknowledgement**

This paper is extracted from a medical student thesis done in Yazd Diabetes Research Center, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.

**References**


Hussain A, Hussain N, Nuthetic R. Comparison of mean macular thickness using optical coherence


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A study on plasma homocysteine level in age-related macular degeneration

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Abstract

Introduction: Age-related macular degeneration (AMD) related to adverse vascular changes is the most frequent cause of irreversible visual impairment in the elderly. Elevated plasma concentrations of serum homocysteine have been shown to increase the risk of vascular disease. Objective: To assess the relationship between plasma homocysteine level and age related macular degeneration. Materials and methods: A case control study was conducted in a tertiary eye care hospital with 32 diagnosed AMD patients. The patients were compared for plasma homocysteine levels with a control group of 32 patients without AMD. A 1.5 ml of fasting venous blood sample was obtained from each participant. Plasma homocysteine level was measured by high performance liquid chromatography. The main outcome measure was hyperhomocysteinemia, defined as a plasma homocysteine level above 15 µmol/L. Results: Hyperhomocysteinemia was found in 10 blood samples (83.3 %) of patients in the wet AMD group, in 16 (80 %) blood samples in the dry AMD group, and in 12 blood samples (37%) of controls. The mean ± SD homocysteine level in the AMD group was 16.86 ± 3.52 µmol/L, while in the non-AMD control group it was 14.53 ± 4.08 µmol/L. This difference was statistically significant (p-value = 0.0186). In the individual analysis, it was also found out that the homocysteine level differed significantly between cases and controls in only the wet variety of AMD. Conclusion: Hyperhomocysteinemia was significantly associated with the wet AMD variety but not with the dry AMD. Thus, homocysteine by oxidative stress and vascular dysfunction can be an important risk factor in the pathogenesis of AMD.

Keywords: Dry AMD, wet AMD, homocysteine

Introduction

Age-related macular degeneration (AMD) is the most common cause for visual impairment in individuals of more than 50 years of age. It is the major challenge of the new millennium in the developing countries as the size of the elderly population continues to rise due to better medical facilities and increased life expectancy. AMD is found to be second only to cataract as the cause of severe visual loss in Asian countries. Three population-based studies, namely the Beaver Dam Eye Study (Klein et al, 1992), Blue Mountain Eye study (Mitchel et al, 1995) and the Rotterdam Study (Vingerling et al, 1995) report the prevalence rates of AMD to be 1.7 % in the US, 1.4 % in Australia and 1.2 % in Netherlands respectively.

In AMD, macular degenerative changes have typically been classified into two clinical forms, dry...
or wet, both of which can lead to visual loss. In the dry (non-exudative) form, visual loss is gradual. Ophthalmoscopy reveals yellow subretinal deposits called drusen, or retinal pigment epithelial (RPE) irregularities, including hyperpigmentary or hypopigmentary changes. Large drusen become confluent and evolve into drusenoid RPE detachments. These drusenoid RPE detachments often progress to geographic atrophy and less frequently to neovascular AMD. Geographic atrophy involving the centre of the macula leads to vision loss. In the wet (exudative) form, vision loss can occur suddenly, when a choroidal neovascular membrane (CNVM) leaks fluid or blood into the subpigment epithelium or subretinal space. Serous RPE detachments with or without coexisting choroidal neovascularization (CNV) are also classified as a wet form. Exudative serous RPE detachments often, but not always, advance to the neovascular stage.

Homocysteine (Hcy), an intermediary amino acid formed during the conversion of methionine to cysteine, is rapidly auto-oxidized in plasma, forming homocystine, mixed disulfides and homocystine thiolactone. Potent reactive oxygen species, including superoxide anion and hydrogen peroxide, are produced during the auto-oxidation of homocysteine. An elevated homocysteine level has been shown to induce vascular injury, aiding in atherothrombogenesis, and this has been considered an independent risk factor for the development of vascular diseases. (Zarbin et al, 2004; Ambai et al, 2003). Several experimental systems have yielded numerous possible mechanisms to account for the vascular effects of homocysteine. Homocysteine has mitogenic activity in vascular smooth muscle cells which could cause arterial wall thickening. It can also induce intracellular release of calcium in these cells, thereby increasing their proliferation and the mass of the extracellular matrix. According to another theory, homocysteine causes oxidative injury to endothelial cells and enhances the peroxidation of low-density lipoprotein, thereby promoting the atheromatous process. Increased homocysteine could also augment thrombotic events, as it inhibits the expression of thrombomodulin secreted by the endothelial cells to prevent the activation of protein C. In addition, homocysteine enhances the activity of factors V and VII and the adhesion of platelets to the endothelium. The toxicity of homocysteine to the vascular endothelium may also account for its association with CNV: homocysteine-induced damage to the choriocapillaris endothelium can lead to vascular occlusion and neovascularization (McCully et al, 1969; Stamler et al, 1993; Upchurch et al, 1997; Jakubowsk, 1997). Alternatively, homocysteine may cause thickening of the choriocapillary vessel wall or induce an increase in the mass of the extracellular matrix in the choroid, thus promoting ischemia with consequent neovascularization. The increased resistance of choroidal vessels and decreased choroidal perfusion may also cause retinal pigment epithelial atrophy and stimulate the release of the vascular endothelial growth factor for neovascularization (Axer Siegel et al, 2004).

Homocysteine can be converted to methionine with folate and vitamin B12 via the major pathway or with choline and betaine via the minor pathway. Epidemiologic studies conducted in the early 1990s have substantiated the presently accepted “normal range” for homocysteine blood levels from 5 to 15 µmol/l in fasting patients. Homocysteine blood levels are sex-related (10 % – 12 % higher in men) and age-related, with a gradual elevation with age, especially in the older population.

The exact cause of AMD remains unknown. AMD is a multifactorial disease of ageing and several theories of pathogenesis have been proposed including oxidative ocular damage (Delcourt et al, 1999; Cai et al, 2000) and ocular perfusion abnormalities (Friedman et al, 1995; Harris et al, 1999). Atherosclerotic vascular disease has been suspected as a risk factor for the development of AMD in the epidemiologic studies by Delaney et al (1982) and Hyman et al (1983). Risk factors for atherosclerotic disease, such as smoking, hypercholesterolemia, decreased estrogen
exposure, and high intakes of fat or cholesterol have also been associated with AMD in the studies by Smith et al (2000) and Cho et al (2001).

On the basis of these findings, it can be hypothesized that AMD may also be associated with elevated plasma levels of homocysteine, an apparently independent risk factor for atherosclerotic vascular disease, as evidenced by Clarke et al (1991) and Rosenberg et al (1999). High levels of plasma homocysteine are toxic to the vascular endothelium by releasing free radicals, creating an environment of hypercoagulability, and modifying the vessel wall. It is possible that changes in the vasculature and antioxidant status as a result of hyperhomocysteinemia may increase the risk of AMD. The aim of the present study was to determine whether hyperhomocysteinemia is involved in AMD.

Materials and methods
The study was conducted in the Ophthalmology and Biochemistry department of a tertiary eye care hospital in eastern India. The study group consisted of 32 consecutive patients with AMD who were examined by a single retina specialist. The control group included 32 age-sex and atherosclerotic cardiovascular disease-matched patients without AMD. The same systemic and ocular exclusion criteria were applied to the persons included in the control group. After obtaining detailed medical history of diabetes, renal disease, hypertension, history of angina pectoris, cardiac or cerebral atherothrombotic events (atherosclerotic cardiovascular disease), smoking, and use of systemic and ocular medications, complete ocular examination with slit-lamp biomicroscopy, fundus photography and fundus fluorescein angiography were performed in all subjects. The exclusion criteria included presence of renal failure, recent unstable angina, myocardial infarction or stroke, anemia, collagen or neoplastic disease and current supplemental therapy with multivitamins, particularly folic acid, vitamin B6 and vitamin B12. Ocular exclusion criteria were diabetic retinopathy, retinal vascular occlusion and anterior ischemic optic neuropathy, as these conditions are found to be associated with elevated plasma homocysteine. The study protocol was approved by the Medical Ethics Committee of the hospital. Written informed consent was obtained from all the study participants.

A 1.5-ml venous blood sample was obtained from each participant after an 8-hour fast. The blood was centrifuged and the plasma removed and frozen until all samples were obtained. The blood was then thawed for homocysteine analysis by high-performance liquid chromatography (HPLC) with fluorescent detection.

The statistical analyses were carried out by using the Statistical Package for Social Sciences software 13.0 for Windows package software (SPSS, Inc., Chicago). The unpaired t-test was used for the variables. P values less than 0.05 were considered as statistically significant.

Results
Thirty-two patients diagnosed with AMD were included in this study as cases. So, the study group included 32 patients (14 male, 18 female) with a mean ± SD age of 67.44 ± 6.54 years (range, 54-79). There were 20 patients (9 male, 11 female) with dry AMD and 12 patients (5 male, 7 female) with wet AMD. The control group included 32 patients (14 male, 18 female), with a mean ± SD age of 66.48 ± 5.91 years (range, 54-79). Proper matching was done between cases and controls with regard to age and sex, atherosclerotic cardiovascular disease and hypertension. There was a smaller proportion of patients with noninsulin-dependent diabetes mellitus in the AMD group, compared with the controls. Hyperhomocysteinemia (plasma homocysteine level >15 µmol/L) was found in 10 blood samples (83.3 %) of patients in the neovascular AMD group, in 16 (80 %) blood samples in the dry AMD group and in 12 blood samples (37%) of the controls. The mean ± SD homocysteine level in the AMD group was 16.86 ± 3.52 µmol/L, while in the non-AMD control group it was 14.53 ± 4.08 µmol/L. The standard error of
mean was 0.621 in the AMD group and 0.7446 in the non-AMD group. The p value found using the unpaired t test (value 2.42) with 60 degree of freedom and a 95% confidence interval was 0.0186. This difference by conventional criteria is considered to be statistically significant and is shown in a tabulated form in Table 1. An analysis was made to find out the relation of homocysteine level in both groups of AMD patients. It was found out that the homocysteine level differed significantly between cases and controls in only the wet variety of AMD (Table 2 & 3).

### Table 1. Homocysteine level and AMD

<table>
<thead>
<tr>
<th></th>
<th>AMD group</th>
<th>Non AMD group</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>Mean Hcy level</td>
<td>16.86</td>
<td>14.53</td>
</tr>
<tr>
<td>SD</td>
<td>3.52</td>
<td>4.08</td>
</tr>
<tr>
<td>SEM</td>
<td>0.621</td>
<td>0.7446</td>
</tr>
<tr>
<td>Min. value</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Max. value</td>
<td>22.3</td>
<td>21.3</td>
</tr>
<tr>
<td>t-test=2.42; DF=60; C.I.=95%; p-value=0.0186</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 2. Homocysteine level and dry AMD

<table>
<thead>
<tr>
<th></th>
<th>AMD group</th>
<th>Non AMD group</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>20</td>
<td>32</td>
</tr>
<tr>
<td>Mean Hcy level</td>
<td>15.99</td>
<td>14.53</td>
</tr>
<tr>
<td>SD</td>
<td>3.37</td>
<td>4.08</td>
</tr>
<tr>
<td>SEM</td>
<td>0.75</td>
<td>0.7446</td>
</tr>
<tr>
<td>Min. value</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Max. value</td>
<td>19</td>
<td>21.3</td>
</tr>
<tr>
<td>t-test=1.326; DF=48; C.I.=95%; p-value=0.1911</td>
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<td></td>
</tr>
</tbody>
</table>

### Table 3. Homocysteine level and wet AMD:

<table>
<thead>
<tr>
<th></th>
<th>AMD group</th>
<th>Non AMD group</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>12</td>
<td>32</td>
</tr>
<tr>
<td>Mean Hcy level</td>
<td>18.325</td>
<td>14.53</td>
</tr>
<tr>
<td>SD</td>
<td>3.39</td>
<td>4.08</td>
</tr>
<tr>
<td>SEM</td>
<td>0.97</td>
<td>0.7446</td>
</tr>
<tr>
<td>Min. value</td>
<td>11.3</td>
<td>7</td>
</tr>
<tr>
<td>Max. value</td>
<td>22.3</td>
<td>21.3</td>
</tr>
<tr>
<td>t-test=2.848; DF=40; C.I.=95%; p-value=0.0069</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Discussion

The association between AMD and atherosclerosis remains controversial, with many case-control studies by Vingerling et al (1995) and Goldberg et al (1988) reporting a positive association and others failing to confirm these findings. Friedman et al (2000) have proposed a model that explains the relationship between neovascular AMD and atherosclerosis. It is based on data that AMD shares both risk factors and pathogenic mechanisms with atherosclerosis, resulting in the deposition of lipid in the sclera and in the Bruch membrane. There is evidence that the scleral lipid results in a decreased choroidal blood flow, as well as in an elevation of the choriocapillary pressure, and the lipids in the Bruch membrane result in basal deposits and drusen and in calcification and fragmentation of the membrane. The hypothesis proposes that it is the combination of elevated choriocapillary pressure, vascular endothelial growth factor and breaks in calcified Bruch membranes that cause CNV. Atherosclerosis may play a direct role in the development of macular degeneration by affecting the flow and permeability of choroidal vessels through thickening of the Bruch membrane and decreased perfusion of choroidal capillaries (Ramrattan et al, 1994). In the choroid, the changes that occur with aging include increased thickness of the Bruch membrane, flattening of the capillaries and narrowing of their lumina, thickening and sclerosis of the precapillary arterioles and focal choriocapillary dropout. Moreover, in patients with advanced stages of AMD, the decrease in choriocapillary density and diameter is significantly greater than in the normal maculae. Using fluorescein angiography, Chen et al (1989) demonstrated delayed choriocapillary filling in patients with AMD and decreased visual acuity. They suggested that the chronic compromise of the choroidal circulation is an important cause of visual impairment in AMD. Atherosclerosis related to aging is suspected to be the underlying cause of this ischemia. Another study by Axer-Siegel et al (2004) demonstrated an association of elevated plasma level of homocysteine.
and exudative neovascular AMD in a cohort of 59 patients.

The present study points to an association of AMD and hyperhomocysteinemia. In this study, the blood samples were drawn in a fasting state in all patients to prevent variability in the homocysteine levels. The AMD patients were consecutive patients examined at the outpatient retina clinic. The compliance rate was good, with all patients agreeing to be tested for homocysteine level. The controls were matched for age and atherosclerotic cardiovascular disease to prevent a bias due to the known positive relation among age, atherosclerotic cardiovascular disease and hyperhomocysteinemia. In our study, hyperhomocysteinemia was found in 83.3% of the patients with neovascular AMD, in 80% of patients with dry AMD and in 37% of age-matched controls. This difference between the total cases and controls was statistically significant after matching for atherosclerotic cardiovascular disease. The results varied significantly while comparing the wet AMD cases with the controls.

Conclusion
Based on the results of our study and supportive theories of previous studies, we can conclude that homocysteine by oxidative stress and vascular dysfunction can be an important risk factor in the pathogenesis of AMD and that supplemented treatment with folic acid, vitamin B6 and vitamin B12 can modify the natural disease process of AMD.

Acknowledgement
Department of Biochemistry, RG Kar Medical College, Kolkata-4, India is specially acknowledged.

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Harris A, Chung HS, Ciulla TA(1999). Progress in measurement of ocular blood flow and relevance to our understanding of glaucoma and


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A comparative study of intraocular pressure measurement by three tonometers in normal subjects
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Abstract

Introduction: Contact Goldmann applanation tonometry (GAT) is gold standard for measuring intraocular pressure; however its routine use is limited by its non-portability and the need for a Slit Lamp Microscope. The Portable Perkins tonometer is also considered gold standard because it is based on the same principles as the GAT. The iCare is a newly introduced, portable, non-contact tonometer (NCT) that measures intraocular pressure (IOP) using a thin metallic probe. Objective: To evaluate reliability and accuracy of IOP measurements using iCare and Keeler Pulsair tonometers against Perkins tonometer. Subjects and methods: A comparative, randomized, prospective clinical study conducted on 166 eyes of 83 (n=83) subjects in the age group 14 to 71 years. The pressures were first recorded by iCare and Pulsair and then by Perkins. The SPSS 11.00 version was used for analysis. Results: Mean pressures and standard deviation (+/-SD) for iCare, Pulsair and Perkins were 14.62(+-2.47), 14.53(+/-3.36) and 13.06(+/-2.69) and the Standard Error of the Mean (SEM) was 0.27, 0.36 and 0.30 respectively. There was a good correlation between iCare and Perkins with statistically significant difference (r=0.610, p <0.05). Regression analysis was performed. Using the Bland-Altman analysis 95% Limits of Agreement (LoA) for iCare and Pulsair were determined as -6.1 to 2.9 and -4.5 to 7.5 respectively. Conclusion: Although both tonometers overestimated the Perkins values, Pulsair showed a better agreement with Perkins tonometer than iCare tonometer.

Keywords: iCare tonometer, Keeler Pulsair tonometer, Goldmann applanation tonometer, Perkins tonometer, Intraocular pressure

Introduction

The only recognizable and treatable risk factor for progression of glaucoma is elevated IOP. The Goldmann tonometer estimates the pressure by measuring the force required to applanate a fixed area of the cornea based on the Imber-Fick Principle. However, it requires a slit lamp microscope and topical anesthetic agents, which have a slight decreasing effect on IOP and can record pressures only in sitting posture (Almubrad TM, 2007). Pressure measurements by GAT depend on corneal biomechanics, curvature and thickness and are widely proved to be inaccurate in post-refractive surgical eyes. Perkins has slightly (1-1.5 mm Hg) lowered values than Goldmann. Nevertheless, it can be safely be used in the post operative period and during the retinal detachment surgery (Vernon SA, 1989; Chiqnell AH, 1971).
The Perkins tonometer is portable, simple and capable of measuring IOP in all positions. Its disadvantage is in the initial slow learning phase, or else it could be considered a reliable alternative to Goldmann (Wallace J, 1968).

Keeler Pulsair is a NCT which does not require a topical anaesthetic based on the principle that the IOP is determined from the time taken for the air jet to applanate the cornea, which in turn is proportional to the power of the air sprayed from the instrument. The instrument has a console consisting of a central air plenum flanked on either side by an infrared light emitter and detector. It has a handle consisting of two buttons one for recording IOP below 30 mm Hg and another above 30 mm Hg (subflux button). Through the eyepiece when a focused and centered target image is seen 8 mm to 16 mm from the corneal apex, that indicated the correct positioning of the hand piece for automatic activation. Jet air is released with click sound and the pressures recorded directly in numerical values on the display screen.

The iCare tonometer (iCare; Tiolat Oy, Helsinki, Finland) is hand-held and has been used for non-invasive measurements of the IOP in animals. It is now being recommended for use in humans. The instrument uses a metallic probe of length 24 mm and weight 11 mg with a diameter of 1 mm plastic cover at its tip to minimize corneal damage. It is held in the nozzle by an electromagnetic field, which moves back and forth when the button is pressed gently. The microprocessor analyses the deceleration of the probe that seems to correlate with the IOP (Dawn EC Roberts, 2005; Martinez-de-la-casa JM et al, 2005).

This study was conducted to establish the validity of the iCare and Pulsair tonometer with Perkins and also to evaluate the repeatability (reliability) of the tonometers in question and whether they could be interchangeable (agreement) or the new iCare could replace the Perkins tonometer. To our knowledge this would be one of few studies available in the literature on the comparison between the iCare and Pulsair with the Perkins tonometer.

Subjects and methods
The Subjects: A total of 83 visually normal individuals were randomly recruited in this study who attended the outpatient department of Ophthalmology between November 2007 and May 2008 with permission granted from Institutional Ethical Committee. Significant refractive errors, diabetes mellitus, hypertension and other anterior segment problems were excluded as would be expected to interfere with the acquisition of pressure levels. Informed consent was obtained from all the subjects regarding the tonometers and the procedures involved. A baseline examination of the anterior segment that included a recording of the best corrected visual acuity, autorefractometry and detailed dilated fundoscopy. Pressure measurements recorded by a single surgeon to reduce the inter-observers’ bias and conventionally the right eye pressures were always recorded before obtaining the left eye measurements.

The procedure: iCare tonometry was done prior to the Pulsair and Perkins procedures to prevent bias due to a reduction in the measured IOP caused by ocular massage effect or by the administering of a local anaesthetic (Ogbuehi KC et al, 2006).

1. The forehead rest of the iCare tonometer was adjusted after loading the electromagnetic probe into its nozzle so as to position the probe at a distance of 4-8 mm from the corneal apex. The smooth movement of the probe was demonstrated to the patients just before commencing the recording. The device was vertically held and the button was gently pressed to obtain six consecutive readings automatically. The final reading was the average which was displayed on the screen as P without a hyphen. The measurements were repeated when P was blinking or accompanied by a hyphen in the upper or lower case according to manufacturer’s catalogue given the pressures taken likewise would be erroneous.

2. During Pulsair tonometry a gap of 8-10 seconds was kept in between measurements as the readings taken continuously could be inaccurate.
The ‘click’ sound of the Pulsair tonometer was demonstrated to the subjects to avoid any scared jerks during the procedure and an average of three readings were obtained (Rao BS et al, 1984).

3. IOP was recorded by Perkins tonometer after instilling 4% lignocaine hydrochloride eye drops and staining the tear film with a fluorescein strip. The forehead rest was adjusted and the gearwheel slightly rotated so that the doubling prism could be released and centered on the corneal apex. The stained tear film was lit in a brilliant green by two cobalt blue bulbs incorporated below the prism, which appeared as mirror-imaged hemispherical mires. The pressures were directly measured by gently rotating the gearwheel further until the inner sides of the two hemispherical mires coincided. This was taken as the endpoint of the IOP measurement. Each small graduation on the rotating wheel equaled 0.2 multiplied by Ten would give the correct pressure levels.

Results
This paper studied a total of 166 eyes of 83 individuals. The data was analyzed using SPSS 11.00 version. The study population consisted of 48 (57.8%) males and 35 (42.2%) females in the age group 14 to 71 years (mean age 42.53 +/- 13.55). The mean age for males and females were 43.7 (+/-13.8%) and 40.9 (+/-13.2%), respectively. The Mean +/- SEM and SD was calculated for both the eyes with each tonometer as shown in Tables 1 and 2. There was no statistically significant difference between iCare and Keeler Pulsair compared to Perkins tonometer (Table 3). The right eye pressures were analyzed for the convenience of finding out the best estimates of the true value by plotting the difference on the Y axis against the mean on the X axis using the Bland-Altman analysis. The difference between the measurements by the two methods should lie within 95% limits of agreement computed as the mean bias +/-1.96 times SD (Srinivas Mantha, 2000; Bland JM, 2003). The bias and 95% LoA were calculated as shown in Figures 1 and 2. The regression analysis was performed for iCare and Keeler Pulsair against Perkins tonometer to determine the linear relationship between them. The slope and intercept with their determination of coefficient (r²) were shown in Figure 3 and 4. The upper and lower limits of predictable intervals for slope and intercept were compared with 95% of LoA of Bland-Altman plots (Table 4). The slope was not equal to zero in either case thereby rejecting the null hypothesis.

Table 1: Descriptive statistics of the three tonometers for the right eyes (n=83)

<table>
<thead>
<tr>
<th>Tonometer</th>
<th>Mean +/- SEM</th>
<th>SD</th>
<th>Minimum IOP</th>
<th>Maximum IOP</th>
</tr>
</thead>
<tbody>
<tr>
<td>iCare</td>
<td>14.62 +/- 0.27</td>
<td>2.47</td>
<td>7</td>
<td>23</td>
</tr>
<tr>
<td>Pulsair</td>
<td>14.53 +/- 0.36</td>
<td>3.36</td>
<td>7.33</td>
<td>25.67</td>
</tr>
<tr>
<td>Perkins</td>
<td>13.06 +/- 0.30</td>
<td>2.69</td>
<td>8</td>
<td>20</td>
</tr>
</tbody>
</table>

Table 2: Descriptive statistics of the three tonometers for the left eyes (n=83)

<table>
<thead>
<tr>
<th>Tonometer</th>
<th>Mean +/- SEM</th>
<th>SD</th>
<th>Minimum IOP</th>
<th>Maximum IOP</th>
</tr>
</thead>
<tbody>
<tr>
<td>iCare</td>
<td>14.51 +/- 0.35</td>
<td>3.15</td>
<td>9</td>
<td>24</td>
</tr>
<tr>
<td>Pulsair</td>
<td>14.46 +/- 0.33</td>
<td>3.06</td>
<td>9.67</td>
<td>26.67</td>
</tr>
<tr>
<td>Perkins</td>
<td>13.21 +/- 0.29</td>
<td>2.68</td>
<td>8</td>
<td>22</td>
</tr>
</tbody>
</table>

Table 3. Paired t test

<table>
<thead>
<tr>
<th>Tonometers</th>
<th>r</th>
<th>Right eyes (n=83)</th>
<th>MD</th>
<th>Exact p</th>
<th>Left eyes (n=83)</th>
<th>MD</th>
<th>Exact p</th>
</tr>
</thead>
<tbody>
<tr>
<td>iCare+Perkins</td>
<td>0.610</td>
<td>0.0001</td>
<td>1.57</td>
<td>0.827</td>
<td>0.004</td>
<td>1.30</td>
<td></td>
</tr>
<tr>
<td>Pulsair+Perkins</td>
<td>0.510</td>
<td>0.002</td>
<td>-1.47</td>
<td>0.648</td>
<td>0.006</td>
<td>-1.25</td>
<td></td>
</tr>
<tr>
<td>iCare+Pulsair</td>
<td>0.545</td>
<td>0.84</td>
<td>0.10</td>
<td>0.510</td>
<td>0.91</td>
<td>0.05</td>
<td></td>
</tr>
</tbody>
</table>

r: Pearson correlation coefficient, p: level of significance, MD: mean difference

Table 4. Regression and Bland-Altman analysis for right eyes (n=83)

<table>
<thead>
<tr>
<th>Tonometers</th>
<th>r²</th>
<th>Slope (x)</th>
<th>Predication interval (intercept y)</th>
<th>95% LoA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perkins vs. iCare</td>
<td>0.3</td>
<td>0.39 to 0.72</td>
<td>5.17 to 9.46</td>
<td>-6.1 to 2.9</td>
</tr>
<tr>
<td>Perkins vs. Pulsair</td>
<td>0.2</td>
<td>0.40 to 0.87</td>
<td>3.02 to 9.36</td>
<td>-4.5 to 7.5</td>
</tr>
</tbody>
</table>

r²: coefficient of determination

Discussion
The Schiotz indentation tonometry has limitations in terms of acquiring the exact pressures and is insufficient for diagnosis and essentially for follow-
up of glaucoma patients (Schiotz H, 1935). The mean+/-SD of age in this study was 42.53 +/- 13.55 that included older subjects who were prone for glaucoma in contrast to the previous study which reported mean IOP +/-SD of 13.6+/-2.3 mm Hg and 13.4+/-2.3 mm Hg measured with GAT and Topcon CT80 NCT in the younger age group 20 to 27 years (22.6+/-1.6) and found no statistically significant difference between the tonometers (Ogbuehi KC et al, 2006). Garcia-Resua C et al (2006) measured the IOP with iCare and Perkins in the younger age group 19 to 21 years and found a mean pressure +/-SEM and SD of 17.94+/-0.48 and 3.88 mm Hg compared to the lowered readings of 14.62+/-0.27 and 2.47 mm Hg in the present study, but the pressure values obtained by Perkins tonometry in the present study were very well correlated indicating the accuracy and precision of Perkins. The low Perkins pressure values could be attributable to the local anesthetic and ocular massage effect due to repeated IOP measurements facilitating the aqueous humor drainage. Although a good correlation was seen between the iCare and Perkins (r=0.610, p<0.0001) and Pulsair and Perkins (r=0.510, p<0.002) tonometries in our study, we found statistically significant difference between the two tonometers similar to the results (r=0.82, p<0.0001) of the study reproducibility and clinical evaluation of the Rebound tonometer (Martinez-de-la-casa JM, 2005). Kontiola A (2004) found a mean difference (MD) +/-SD of 0.31 +/-2.45 and 0.36 +/-2.17 for the right and left eyes with r=0.84 and r=0.80. These findings were closely comparable to the values 0.10 +/-3.36 and 0.05 +/- 3.06 for the respective eyes in the present study.

Whitty HP et al (1969) showed a very strong correlation of 0.962 and 0.978 for the right and left eyes between Perkins and Goldmann with MD of 1-1.5 mm Hg. The high correlation coefficient is misleading and shows only the degree of association between the two methods of measurements. But it does not imply anything about the reliability and agreement or accuracy between the two tonometers. The paired t test is definitely not appropriate for showing the agreement between the
two quantitative measurements. Therefore, we went further in order to calculate the 95% LoA by plotting the mean versus the difference between the iCare and the Keeler Pulsair against the Perkins tonometer. The data points for both tonometers were distributed above and below the zero bias line suggesting that there was no consistent bias of one method over the other. iCare measured the IOP less by -6.1 mm Hg and more by 2.9 mm Hg compared to Perkins tonometer. Although the mean negative bias for iCare was -1.6, and it was found that only 90.36% of data points were lying within 95% LoA. About 9.64% (8 points) were outside the limits that raised the question of good agreement between iCare and Perkins tonometers (Figure 1). This was in contrast with the previous study that showed a MD of -3.35 mm Hg (+/-2.28) with 95% LoA between the iCare and Perkins with the difference plots lying between -7.81 and 1.12. But it did not show the proportion of points lying outside the 95% limits (Garcia-Resua C, 2006). Similarly, Davies LN et al (2006) reported LoA differently for iCare as +/-5.11 mm Hg and for GAT as +/-3.15 mm Hg with p<0.05.

Keeler Pulsair measured IOP less by -4.5 or more by 7.5 mm Hg with a positive bias of 1.5 mm Hg compared to Perkins tonometer with 97.59% of points lying between the 95% acceptable limits and only 2.41% (2 points) lying outside the LoA thereby, proving a very good agreement with the Perkins tonometer shown in figure 2. Parker VA et al, (2001) reported that 95% of the Pulsair 3000 results fell between 1.75 and 2.72 mm Hg with a mean value of 0.48 mm Hg compared with GAT. When the range of pressure values was considered both the iCare and the Keeler Pulsair tonometers overestimated the Perkins pressure values. To confirm that one method was overestimating the high values or underestimating the low values all the data points should lie above or below the zero bias line respectively which was not observed in our study.

There was a slight difference of the slope and intercept in the regression analysis equation for both the tonometers since for every unit change in the Perkins value, iCare and Pulsair tonometric pressures were increased by 0.56 to 0.64 mm Hg. From coefficient determination (r²), the proportion of variance between iCare and Pulsair was found to be 37% and 26% respectively. The regression line for Pulsair and Perkins was closely approximated the data points showing goodness of curve fitting compared to iCare and Perkins tonometer. One outlier was observed for both the iCare and Pulsair tonometers in the regression graph as a result of high IOP recordings. To find out the tonometer which is closer to Perkins, we analysed the 95% LoA and prediction interval of slope and the intercept of iCare and Pulsair. It was observed that the width of the intervals and the range of 95% limits were not in an acceptable range signifying that both the tonometers could not replace Perkins tonometer. iCare picked up pressures more than 21 mm Hg in five eyes, Pulsair in seven eyes and Perkins in one eye. There was a trend towards measuring lower IOP values for the left eyes which was not consistently found in the present study.

The iCare tonometer can be employed as a home tonometer, useful on scarred corneas and to find out the peripheral IOP in post Keratoplasty and post surgical corneas (Cervino A, 2006). It can easily be handled by technical personnel with a few minutes of training. It is advantageous in eliminating the chances of cross-infection and contamination. It is useful in patients with cervical spine problems, patients in wheelchairs, in children, obese and bedridden who have difficulties in positioning the chin on the Slit Lamp Microscope. (Choi WJ, 1990; Amin SZ, 2003; Tonnu PA, 2005).

The limitation of this study was smaller sample size and IOP was measured without the inclusion of central corneal thickness which has an impact on the pressures recorded especially with Goldmann and Perkins Tonometers.

**Conclusion**

The two tonometers in question could be used interchangeably if the limits of agreement is not clinically important but upto the upper limit of IOP of 21 mm Hg. A confirmation of pressures is obtained by Goldmann or Perkins Tonometer.
whenever iCare or Pulsair measures high IOP values. Both iCare and Pulsair tonometers recorded pressures reliably without topical anaesthesia and therefore may be employed for mass screening, diagnosis and follow up of glaucoma cases.

References


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Indications for keratoplasty in Nepal: 2005 - 2010

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Abstract

Introduction: Corneal disease, especially infective keratitis, is one of the major causes of visual impairment and blindness in developing countries. Objective: To find out the current indications for keratoplasty, how these indications have changed over time as well as how they are different from those in other parts of the world. Materials and methods: A retrospective study of a case series of 645 keratoplasty surgeries (589 patients) was conducted at the Tilganga Institute of Ophthalmology from January 2005 to December 2010. Outcome measures: The cases were evaluated in terms of demographic parameters, preoperative diagnosis and the type of surgery performed. Results: The most common indication for surgery was active infectious keratitis (264 eyes, 40.9%), followed by corneal opacity (173 eyes, 26.8%), regraft (73 eyes, 11.2%), bullous keratopathy (58 eyes, 9.0%), keratoconus (45 eyes, 7.0%) and corneal dystrophy (11 eyes, 1.7%). The mean recipient age was 41.7 ± 19.9 years with over a half of the patients between 15 to 49 years of age. More men (64.1%) underwent keratoplasty than women (35.8%). 59.8% of the eyes with infectious keratitis had a perforated corneal ulcer. 49.7% of corneal opacities were due to previous infectious keratitis. 72% of regrafts were for endothelial failure of various causes. In older patients (>50 years), bullous keratopathy was an important indication, after infectious keratitis. Keratoconus and corneal scar were major causes of keratoplasty in children of 14 years or less. Four percent of the patients had keratoplasty in both the eyes. 17.1% of the patients who had one eye operated on had a blind fellow eye with a vision of less than 3/60. Conclusion: Currently, keratitis, either active or healed, is the major indication for keratoplasty, suggesting that improved primary eye health care is necessary to decrease the prevalence of corneal blindness.

Keywords: keratoplasty, infectious keratitis, developing countries, corneal blindness
Indications for keratoplasty have made it difficult to keep up with the escalating tissue demands. This study examines the indications for keratoplasty, including demographics and types of surgeries performed in the TIO, a tertiary eye center in Kathmandu, Nepal. The findings of the study are compared with those in the published literature, including that of ours (Tabin et al, 2004).

Materials and methods
Patient records of all consecutive cases of keratoplasty performed in the TIO between January 2005 and December 2010 were retrospectively reviewed. Information collected from the records included: age, sex, the distance the patients had to travel to reach the TIO, preoperative diagnosis, preoperative visual acuity of both eyes, type of surgery (penetrating keratoplasty (PK), deep anterior lamellar keratoplasty (DALK), Descemet’s stripping and automated endothelial keratoplasty (DSAEK), patch graft, or others) and the procedures performed in addition to the main surgery. The patients were stratified into three age groups: 0 to 14 years, 15 to 49 years, and 50 years and above. Indications for keratoplasty were divided into seven main diagnostic categories: infectious keratitis, corneal opacity, regrafts, bullous keratopathy, keratoconus, corneal dystrophy, and others. Keratoplasty performed for active bacterial, fungal or viral ulcers were included under infectious keratitis. For patients with corneal opacity and regrafting, the causes for opacification and reasons for the graft failure were noted. The ‘others’ category included: metabolic corneal disorders, corneal degenerations and tectonic patch grafts for peripheral corneal diseases or scleral thinning.

Results
Demographics
A total of 645 eyes from 589 patients were reviewed for this study. The mean patient age at the time of surgery was 41.7 ± 19.9 years (range 15 months to 87 years). More than 50% of the patients were 15 to 49 years old (Table 1). 378 (64.2%) patients were male and 211 (35.8%) were female.

Table 1: Distribution of surgeries by age group

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Surgical eyes</th>
<th>Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;15</td>
<td>40 (6.20%)</td>
<td>34 (5.80%)</td>
</tr>
<tr>
<td>15 to 49</td>
<td>356 (55.2%)</td>
<td>323 (54.8%)</td>
</tr>
<tr>
<td>50+</td>
<td>249 (38.6%)</td>
<td>232 (39.4%)</td>
</tr>
<tr>
<td>Total</td>
<td>645</td>
<td>589</td>
</tr>
</tbody>
</table>

One hundred and forty-four (24.5%) patients were from the Kathmandu Valley, a 220 square mile area encompassing three urban districts: Kathmandu, Lalitpur and Bhaktapur. Three hundred and eighty-nine (66.0%) came from the remaining 72 districts of Nepal (Figure 1). Fifty-six patients (9.50%) were from foreign countries, the majority of them (49 patients, 87.5%) from India. The others were from Bhutan (4), Cambodia (2) and Tibet (1). Of the patients who underwent keratoplasty for infectious keratitis, 79.8% were from the districts outside the Kathmandu Valley and 8.9% were from India.

Pre-operative visual acuity
The majority of the operated eyes (584 of 645, 90.5%) had a pre-operative vision of < 6/60. Six eyes (< 1%) had a vision of 6/6 to 6/18, and required keratoplasty for peripheral corneal disease or scleral thinning. Twenty-four patients (4%) had bilateral keratoplasty done. Of the 565 patients who had only one eye operated on, 97 (17.1%) had a blind fellow eye (vision < 3/60); 82 (14.5%) of the fellow eyes were visually impaired with the best corrected vision of < 6/18 and > 3/60.

Indications
The most common indication for keratoplasty was infectious keratitis (40.9%), followed by corneal opacity (26.8%), regraft (11.3%), bullous keratopathy (BK) (9.0%), keratoconus (7.0%) and corneal dystrophy (1.7%) (Table 2 and Figure 2).
Causes of corneal opacity

- Infective keratitis: 86 (49.7%)
- Microbial keratitis: 50 (58.1%)
- Viral keratitis: 36 (41.9%)
- Trauma: 39 (22.5%)
- Unspecified: 32 (18.5%)
- Vitamin A deficiency: 9 (5.20%)
- Others*: 7 (4.0%)
- Total: 173

Graft pathology

- Endothelial failure: 53 (72.6%)
- Endothelial rejection: 16 (30.2%)
- Primary failure: 9 (17.0%)
- Glaucoma: 4 (7.60%)
- Cataract surgery: 1 (1.90%)
- Other: 23 (43.3%)
- Infective keratitis: 10 (13.7%)
- Microbial keratitis: 3 (30.0%)
- Viral keratitis: 7 (70.0%)
- Trauma: 5 (6.85%)
- Others*: 5 (6.85%)
- Total: 73

Unspecified interstitial keratitis, corneal scar of congenital glaucoma, chemical injury

Of the eyes with BK, 40 (68.9 %) had a posterior chamber intraocular lens (PCIOl), 8 (13.7 %) had an anterior chamber intraocular lens (ACIOl), nine (15.5 %) were aphakic and one was phakic (1.72 %). Fifty-five eyes (94.8 %) with BK were sequellae of cataract surgery and the remaining were due to corneal trauma.

Stratifying by age (Table 5), the most common indications for surgery were infectious keratitis and corneal opacity in the 15 to 49 years group, and infectious keratitis and BK in the over 50 years group. Corneal opacity and keratoconus were the most common causes for keratoplasty in children under 15 years of age.

Table 4: Causes of graft failure

<table>
<thead>
<tr>
<th>Graft pathology</th>
<th>Surgical eyes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endothelial failure</td>
<td>53 (72.6%)</td>
</tr>
<tr>
<td>Endothelial rejection</td>
<td>16 (30.2%)</td>
</tr>
<tr>
<td>Primary failure</td>
<td>9 (17.0%)</td>
</tr>
<tr>
<td>Glaucoma</td>
<td>4 (7.60%)</td>
</tr>
<tr>
<td>Cataract surgery</td>
<td>1 (1.90%)</td>
</tr>
<tr>
<td>Other</td>
<td>23 (43.3%)</td>
</tr>
<tr>
<td>Infective keratitis</td>
<td>10 (13.7%)</td>
</tr>
<tr>
<td>Microbial keratitis</td>
<td>3 (30.0%)</td>
</tr>
<tr>
<td>Viral keratitis</td>
<td>7 (70.0%)</td>
</tr>
<tr>
<td>Trauma</td>
<td>5 (6.85%)</td>
</tr>
<tr>
<td>Others*</td>
<td>5 (6.85%)</td>
</tr>
<tr>
<td>Total</td>
<td>73</td>
</tr>
</tbody>
</table>

*Vascularization, astigmatism due to patch graft, recurrence of primary disease

Table 5: Indications for keratoplasty in <50, >50 age group and <14 years

<table>
<thead>
<tr>
<th>Indications</th>
<th>15 to 49 year (Surgical eyes)</th>
<th>&gt;50 years (Surgical eyes)</th>
<th>&lt;14 years (Surgical eyes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infective keratitis</td>
<td>142 (39.8%)</td>
<td>114 (45.7%)</td>
<td>8 (20.0%)</td>
</tr>
<tr>
<td>Perforated ulcer</td>
<td>87 (61.3%)</td>
<td>66 (57.9%)</td>
<td>5 (62.5%)</td>
</tr>
<tr>
<td>Non healing ulcer</td>
<td>55 (38.7%)</td>
<td>48 (42.1%)</td>
<td>3 (37.5%)</td>
</tr>
<tr>
<td>Corneal opacity</td>
<td>113 (31.7%)</td>
<td>47 (18.8%)</td>
<td>13 (32.5%)</td>
</tr>
<tr>
<td>Regraft</td>
<td>44 (12.3%)</td>
<td>27 (10.8%)</td>
<td>2 (5.00%)</td>
</tr>
<tr>
<td>Bullous keratopathy</td>
<td>8 (2.2%)</td>
<td>49 (19.6%)</td>
<td>1 (2.50%)</td>
</tr>
<tr>
<td>Keratoconus</td>
<td>31 (8.7%)</td>
<td>1 (0.4%)</td>
<td>13 (32.5%)</td>
</tr>
<tr>
<td>Corneal dystrophy</td>
<td>6 (1.6%)</td>
<td>2 (0.8%)</td>
<td>3 (7.50%)</td>
</tr>
<tr>
<td>Others*</td>
<td>12 (3.3%)</td>
<td>9 (3.6%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Total</td>
<td>356</td>
<td>249</td>
<td>40</td>
</tr>
</tbody>
</table>
Procedures Surgical eyes
Penetrating keratoplasty (PK) 560 (86.8%)
Deep anterior lamellar keratoplasty (DALK) 46 (7.1%)
Descemet's stripping automated endothelial keratoplasty (DSAEK) 19 (2.9%)
Patch graft 10 (1.5%)
Others* 10 (1.5%)
Total 645

Keratoplasty Associated procedure Surgical eyes
PK ECCE PCIOL 96 (76.2%)
Secondary IOL 9 (7.14%)
ECCE 5 (3.97%)
Removal of IOL 3 (2.37%)
Intravitreal injection 3 (2.37%)
Others* 8 (6.45%)
Total 124

Table 6: Types of keratoplasties performed

Table 7: Procedures performed alongside keratoplasty

Discussion

Demographics

Surgical information

The vast majority of the surgeries performed were penetrating keratoplasties (PK) (560 eyes, 86.8%). There was a much smaller number of DALK (46 eyes, 7.1%), DSAEK (19 eyes, 2.9%) and patch grafts (10 eyes, 1.5%) (Table 6). 124 eyes (19.2%) had additional procedures performed simultaneously with the main surgery, the majority (76.2%) being extracapsular cataract extraction (ECCE) with PCIOL implantation (Table 7).

There was a 19.5% increase in the overall number of keratoplasties performed in this study period, compared to that of our report of the period of 1994 to 1999 (Tabin et al, 2004).
By gender, more males underwent keratoplasty than females (1.79:1), similar to that in India (Sony et al, 2005; Dandona et al, 1997); but in China, this ratio was even greater (2.7:1) (Xie et al, 2009). The ratio was lower in the UK (1.2:1) (Yousuf et al, 2004), and was seen to be flipped in the USA (0.88:1) (Ghosheh et al, 2008). The observed trends in the developing countries may be explained by two different gender bias theories. Firstly, males frequently have more privileged access to health care and treatment facilities, and thus may have made up more of the surgical population. Secondly, the typical male occupations in the developing world (i.e., agriculture and hard labor) could have made them more prone to work-related trauma, leading to keratitis.

Keratoplasty in patients under the age of 15 years accounted for only 40 eyes (6.2 %), which is similar to the proportion in France (5.2 %) (Legeais et al, 2001) (Tables 1 and 5). As mentioned previously, keratoconus and corneal opacity were the most common indications for surgery in the under 15 years group (32.5 % each), followed by infectious keratitis (20 %) (Table 5). In the USA, a review of 106 pediatric keratoplasties showed congenital corneal opacity and dystrophy as 61 %, while infectious causes accounted for 18.4 % and keratoconus for only 3.3 % (Huang et al, 2009). In India, 43 % of pediatric keratoplasties (out of 168) are reportedly done for healed or active keratitis and 33.9 % for congenital causes but none for keratoconus (Sharma et al, 2007). A small pediatric sample size was the limitation of our study.

Although the Nepal Eye Bank has been providing a greater number of corneas than previously, there are still barriers to performing a greater number of keratoplasties in Nepal. These include a continued shortage in locally available corneal tissue, an undersupply of corneal surgeons, and, especially in the peripheral hospitals, lack of the surgeon’s time for corneal subspecialty care due to the high demand for other ophthalmologic services. The high demand for corneas necessitates criteria for selecting patients for surgery in non-emergency situations. One of the major factors taken into account when projecting graft survival is the likelihood of the patient’s follow-up. In Nepal, it is difficult for patients from remote areas to reach a tertiary eye center, so patients need to be selected on the basis of possible follow-up care. Exceptions to this selection criterion include therapeutic keratoplasty and bilaterally blind patients. Both these groups should naturally get priority on the waiting list.

A significant portion of the patients in this study lived in the Kathmandu Valley and the surrounding districts (Figure 1), due to the above selection criteria. However, fewer patients were from the Kathmandu Valley in this study than were in our previous study. Previously, 49.4 % of the keratoplasty patients were from the Kathmandu Valley (Tabin et al, 2004), whereas only 24.5 % of the patients were from the Valley in this study. The reduced proportion of the patients from the Valley is likely because the TIO performs a larger number of emergency eye saving transplants at present, whereas in the past, the majority of the transplants were done for optical purpose (72 %). The majority of the patients (79.8 %) needing keratoplasty for infective keratitis in this study were from outside the Valley.

**Infectious keratitis**

The leading indication for keratoplasty in this study was active infectious keratitis (40.9 %), which differs from the reports from India, Taiwan and Thailand, where active infections were second (Sony et al, 2005; Dandona et al, 1997), third (Chen et al, 2001) and fourth (Chaidaroon et al, 2003) respectively. Although our findings were more similar to those in other developing countries, where corneal ulceration is considered a silent epidemic (Whitcher et al, 1997), the similarities do not carry over to the developed world. In the UK, for example, only 8.3 % of grafts were done for infective keratitis (Yousuf et al, 2009). The high rates of active infection demand the need for primary eye care services.

Since the TIO is a tertiary referral centre in Nepal for cornea service, many patients with ulcerative
keratitis present at a severe, perforated or intractable stage requiring keratoplasty.

**Corneal scar**

Corneal scar is the second commonest cause for keratoplasty (26.8%). In this study, the leading cause of corneal opacification was previous infective keratitis, followed by trauma. The proportion of trauma related scars is similar to that reported from India (16.7-21.0%) (Sony et al, 2005; Dandona et al, 1997). Corneal scar is a much less frequent indication for keratoplasty in the developed world, accounting for only 2.5 % of the keratoplasties in France (Legeais et al, 2001) and <2.5 % in the USA (Ghosheh et al, 2008). The majority of the cases with unspecified etiology (18.5%) for corneal scarring in our study are also likely to be attributable to keratitis. In the developing world, keratitis is frequently associated with agriculture related trauma (Whitcher et al, 1997), lack of education, lack of accessibility to eye care facilities and poverty.

Ten years ago, at the time when keratoplasty was started regularly at the TIO, the primary indication was corneal scar (72%) (Tabin et al, 2004). During that time, there had been a large backlog of the patients blind from old infectious keratitis; surgery for active infectious keratitis was less commonly performed. As the awareness of eye diseases in Nepal has improved, the number of patients presenting to the corneal service for active infectious keratitis treatment has increased. This is likely to explain the increased proportion of keratoplasty performed for active infectious keratitis in this report. As Nepal’s primary and secondary eye health services expand, it is anticipated that infectious keratitis will be more successfully treated or prevented so that less therapeutic and tectonic keratoplasties will be required.

**Regraft**

It was the third indication for keratoplasty in our study (11.3%). Graft failure was the most common indication for keratoplasty in the UK (41%) (Ghosheh et al, 2008) and accounted for 22 % of the cases in the USA (Yousuf et al, 2009) versus 5.28 % in Iran (Kanavi et al, 2007). In our study, the majority of graft failures were due to endothelial decompensation (Table 4), whereas in India, ocular surface problems (33 %), allograft rejection and endothelial failure (together 28.2 %) were the major causes (Vanathi et al, 2005). In the UK, 42 % of regrafts were for endothelial failure and 16.5 % for rejection (Yousuf et al, 2009). It is recognized that keratoplasty in the setting of active inflammation decreases the long term survival rates of the corneal graft (Yorston et al, 1996). As the rates of keratoplasty continue to rise in Nepal and surrounding countries, regrafting is likely to make up a larger proportion of the indications for keratoplasty in the near future.

**Bullous keratopathy**

The fourth indication for keratoplasty was BK (9 %). In the USA and New Zealand, it was one of the top two reasons for keratoplasty (Ghosheh et al, 2008; Edwards et al, 2002). In our study, 48 eyes (82.7 %) were pseudophakic (PCIOL [68.9%], ACIOL [13.7%]) and only 15.5 % were aphakic. Since the establishment of the Fred Hollows Intraocular Lens Laboratory in the TIO in 1994, ECCE with PCIOL implantation has been possible to be performed at a lower cost and more widely, making aphakia less common than in the other developing countries, where the prevalence of aphakic BK is higher (Sony et al, 2005; Dandona et al, 1997; Kanavi et al, 2007). The proportion of keratoplasties performed for BK is expected to increase in the near future as more preventable causes of keratoplasty drop and cataract surgery rates increase.

**Keratoconus**

Keratoconus ranks fifth in our study (7%), and was similar to rates in India (2% to 6%) (Sony et al, 2005; Dandona et al, 1997), but lower than that in New Zealand, France and Iran, where it accounted for 29 % to 45 % of cases (Legeais et al, 2001; Kanavi et al, 2007; Edwards et al, 2002). In the UK and USA, keratoconus was the third common cause for keratoplasty accounting for 15 - 16 %,
whereas in Taiwan, it played a role in only 2.5% of the cases (Yousuf et al, 2009; Ghosheh et al, 2008; Chen et al, 2001). The low rates of keratoconus in Nepal and India may be due to the greater ethnic diversity than in the European populations (Mamalis et al, 1992).

**Dystrophy**
The corneal dystrophies were relatively uncommon indications (1.7%) in our study, and Fuchs’ dystrophy was negligible. The studies from India have reported slightly higher rates of non-Fuchs’ dystrophy (3.8 - 8.4%), but similar rates of Fuchs’ dystrophy (0.74 - 1.2%) (Sony et al, 2005; Dandona et al, 1997). In the UK and USA, <4% of keratoplasties were done for non-Fuchs’ dystrophy and around 10% for Fuchs’ dystrophy (Yousuf et al, 2009; Ghosheh et al, 2008). The more pressing need for surgery for active or healed infectious keratitis in Nepal may be the reason for the relatively low number of keratoplasties for dystrophy.

**Surgical progress**
Major advances in corneal surgery have been made in the TIO in the past decade. Improvements in techniques have increased the number of DALKs and DSAEKs performed. The long term benefits of DALK surgery, where endothelial failure and rejection are less of a risk, cannot be overemphasized in a country like Nepal, where people live far from an eye hospital and often cannot come for follow-up visits (Tabin et al, 2004). The first keratoprosthesis surgery was successfully performed at the TIO on a one-eyed patient with recurrent graft failure. Nevertheless, PK remains the most common procedure due to the predominance of infectious etiologies and because corneal leukomas are often of full thickness, necessitating PK (Table 6). The ECCE and PCIOL is the commonest procedure performed along with the keratoplasty because of increased prevalence of complicated cataract associated with keratitis (Table 7). Two eyes with Fuch’s dystrophy underwent combined ECCE and PCIOL and DSAEK in the present study.

**Conclusion**
The indications for keratoplasty in Nepal, in decreasing order of frequency are infective keratitis, corneal opacity, regraft, bullous keratopathy, keratoconus and corneal dystrophy. The importance of reducing corneal blindness is clear by the number of working age patients affected, with probable harmful socioeconomic impacts.

The shift in indications for keratoplasty over the past decade demonstrates that it is possible to expand a keratoplasty program in a developing country over a relatively short period of time and outlines where attention should be focused for future progress.

**References**


Keratometric astigmatism evaluation after trabeculectomy

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Abstract

Introduction: Post-operative astigmatism is one of the most important causes for diminution of vision after trabeculectomy. Objective: To evaluate the induced corneal astigmatism following trabeculectomy with the use of 8-0 silk suture. Materials and methods: A prospective interventional study was done including 100 consecutive eyes of 84 patients who underwent trabeculectomy with the use of 8-0 silk suture. The post-operative induced astigmatism on the 1st post-operative day, 3rd week and after 6 months was determined. Statistics: Vector analysis was performed on the data using a computerized method for calculating the surgically induced astigmatism (SIA) for each eye at every time point postoperatively. In order to analyze group changes, we also performed vector decomposition which gave us a mathematical expression of the changes in astigmatism “with the rule” (WTR) or “against the rule” (ATR). Results: The mean age of all the patients was 53.31 ± 11.39 years. The mean 1st post-operative surgically induced astigmatism (SIA) was 2.73 D (99 degree) which reduced to 0.41 D (58 degree) at the 3rd week and 0.43 (21 degree) at 6 months. The mean WTR astigmatism was 4.46 D and ART astigmatism was 1.42 D on the 1st post-operative day which was significantly high (p<0.0001). At the 3rd week and 6 months WTR astigmatism (1.40 D and 1.08 D) and ATR astigmatism (1.27 D and 1.10 D) showed no significant changes (p=0.69, 0.97 respectively. Conclusion: Trabeculectomy with the use of 8/0 silk sutures showed significantly high 1st post-operative day SIA which nevertheless perished fast to a minimum amount at just 3 weeks.

Keywords: keratometer, computerized surgically induced astigmatism calculator, astigmatism, trabeculectomy

Introduction

Trabeculectomy, since its introduction in 1968 (Cairns, 1968) has become the gold standard surgical procedure for progressive open angle glaucoma. Post-operative astigmatism is one of the most important causes for diminution of vision.

Materials and methods

This was a prospective interventional study conducted between March 2011-2012. Following ethics committee approval and informed consent. A total 100 eyes of 84 patients were taken. The patients who presented in glaucoma clinic and were advised filtration surgery were included in this study. None of the eyes had any previous ocular surgery or significant corneal opacity. All surgeries were done by two experienced surgeons. A fornix based conjunctival flap was fashioned. Sufficient scleral cautery was then performed using a battery powered bipolar cautery. A 3 mm x 4 mm rectangular sclera trap door was constructed at
the 90 degree meridian and an anteriorly positioned internal sclerostomy of size 1 - 1.5 mm in diameter was achieved with a Kellys punch. A small basal peripheral iridectomy was performed. Superficial sclera flap was sutured with two 8/0 silk sutures. The conjunctiva was closed with the same suture material. The postoperative medications routinely used were atropine 1% drops three times a day for one week, antibiotic- steroids drops for one month in a tapering dose. No suture manipulations by laser or otherwise were done post-operatively.

**Statistics**

The data were analysed using the automated keratometry (Nikon Retinomax Kplus 2 ) and SIA calculator version 2.1 were performed at 1st post op day, 3 weeks and 6 months post-operatively. Vector analysis was performed on the data using a computerised method of calculating the surgically induced astigmatism (SIA) for each eye at every time point postoperatively.

All changes were compared with the preoperative data set and expressed in terms of plus cylinders. SIA is based on the theory that the combination of two cross spherocylinders produces a third spherocylinder. This provides a vector of induced cylinder for each eye at each time point.

Each astigmatism data was converted into Cartesian coordinates based system, where each astigmatism vector was assigned a position represented (x, y) x = a cos 2p where a is magnitude of astigmatism y = a sin 2p where p is the axis of steep meridian.

x and y values generated for both pre op and postoperative data. Thus we now have Xpre, Ypre and Xpost, Ypost.

To calculate SIA

\[ X_{SIA} = X_{post} - X_{pre} \]
\[ Y_{SIA} = Y_{post} - Y_{pre} \]

Astigmatism vector

- Magnitude = \( \sqrt{X_{SIA}^2 + Y_{SIA}^2} \)
- Angle = 0.5 x arc tan ( Y_{SIA}/X_{SIA} )

With this equation we analysed the aggregate astigmatism data ( centroid) by using mean X-Y value of pre, post and SIA.

In order to analyse group changes, we also performed vector decomposition which gave us a mathematical expression of the changes in astigmatism “with the rule” (WTR) or “against the rule” (ATR). WTR astigmatism is defined as corneal steepening in the vertical meridian corresponding to a positive induced cylinder at 90 degrees and ATR being the reverse. This results in magnitude of change WTR and ATR for each eye. Student paired- t test was performed on the collective WTR and ATR data at each time point to determine whether there was a statistically significant induction of astigmatism in either axis with respect to the other.

**Results**

Mean age of all case was 53.31 11.39 years. Out of the 32 eyes of 27 patients, 12 (44.4 %) were male and 15(55.5 %) were female patient.

The mean (SD) preoperative intraocular pressure (IOP) on medications was 23.38 (9.78) mm Hg and the mean ( SD) IOP at the 1st post operative was 13.91( 4.20) mm Hg. ( p < 0.0001 by paired t test ) and at 3rd week- 12.44 (2.79) mm Hg ( p < 0.0001) , and at 6 month was 12.38(3.34) mm Hg (p < 0.0001) None was receiving anti glaucoma medications at 6 months following surgery. Post-op IOP reduction was 40.50% 46.79%, 47.04% at 1st post op, 3rd week and 6 months respectively (table 1).

**Table 1**

<table>
<thead>
<tr>
<th>MEAN (mm Hg)</th>
<th>SD</th>
<th>% Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre- operative (with medication)</td>
<td>23.38</td>
<td>9.78</td>
</tr>
<tr>
<td>1st post operative day</td>
<td>13.91 (P &lt;0.0001)</td>
<td>4.20</td>
</tr>
<tr>
<td>3rd WEEK</td>
<td>12.44 (P&lt;0.0001)</td>
<td>2.79</td>
</tr>
<tr>
<td>6th MONTH</td>
<td>12.38 (P&lt;0.0001)</td>
<td>3.34</td>
</tr>
</tbody>
</table>
Astigmatism (as plus cylindrical formate) was calculated by vector analysis. Pre operative and post operative values for 32 eyes at each time point are given in Table 2 (a, b, c). Table 2 (a) indicates vector analysis at 1st post-op day.

The mean pre-operative astigmatism was 0.13D x 159 degrees and surgical induced astigmatism (SIA) was +2.73D x 99 degrees at 1st post operative day that was significantly high with the rule (WTR) astigmatism. Mean SIA at 3rd week was +0.41D x 58 degrees (WTR), and at 6th month it was 0.43 D x 21 degrees which is against the rule astigmatism (ATR).

**Table 2(a)**: vector astigmatism analysis at 3rd week. x and y represent cartesian coordinates of vector. Coherence indicate reliability of centroid (mean astigmatism).

<table>
<thead>
<tr>
<th></th>
<th>Mean (SD) X</th>
<th>Mean (SD) Y</th>
<th>Mean astigmatism (Centroid) Magnitude x axis</th>
<th>coherence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre op</td>
<td>0.10 (1.08)</td>
<td>-0.08 (0.77)</td>
<td>0.13 D x 159 degrees</td>
<td>14%</td>
</tr>
<tr>
<td>Post op</td>
<td>-2.49 (3.25)</td>
<td>-0.95 (1.63)</td>
<td>2.67 D x 101 degrees</td>
<td>71%</td>
</tr>
<tr>
<td>SIA</td>
<td>-2.58 (3.10)</td>
<td>-0.87 (1.94)</td>
<td>2.73 D x 99 degrees</td>
<td>72%</td>
</tr>
</tbody>
</table>

**Table 2 (b)**: Vector astigmatism analysis at 3rd week. The X and Y represent Cartesian coordinates of vector. Coherence indicates reliability of mean astigmatism.

<table>
<thead>
<tr>
<th></th>
<th>Mean (SD) X</th>
<th>Mean (SD) Y</th>
<th>Mean astigmatism (Centroid) Magnitude x axis</th>
<th>coherence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre op</td>
<td>0.10 (1.08)</td>
<td>-0.08 (0.77)</td>
<td>0.13 D x 159 degrees</td>
<td>14%</td>
</tr>
<tr>
<td>Post op</td>
<td>-0.09 (1.24)</td>
<td>0.28 (0.85)</td>
<td>0.36 D x 54 degrees</td>
<td>61%</td>
</tr>
<tr>
<td>SIA</td>
<td>-0.18 (1.15)</td>
<td>0.36 (1.05)</td>
<td>0.41 D x 58 degrees</td>
<td>51%</td>
</tr>
</tbody>
</table>

**Table 2(c)**: The vector astigmatism analysis at 6th months. x and y represent cartesian coordinates of vector. Coherence indicates reliability of centroid (mean astigmatism).

<table>
<thead>
<tr>
<th></th>
<th>Mean (SD) X</th>
<th>Mean (SD) Y</th>
<th>Mean astigmatism (Centroid) Magnitude x axis</th>
<th>coherence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre op</td>
<td>0.10 (1.08)</td>
<td>-0.08 (0.77)</td>
<td>0.13 D x 159 degrees</td>
<td>14%</td>
</tr>
<tr>
<td>Post op</td>
<td>0.40 (1.04)</td>
<td>0.20 (0.58)</td>
<td>0.46 D x 13 degrees</td>
<td>47%</td>
</tr>
<tr>
<td>SIA</td>
<td>0.31 (1.04)</td>
<td>0.29 (0.58)</td>
<td>0.43 D x 21 degrees</td>
<td>39%</td>
</tr>
</tbody>
</table>

Table 3 shows the mean decomposed vectors at each time point. The statistical p values relate to comparison of WTR and ATR induced cylinders at each time point by the Welch’s unpaired t test. The mean (SD) pre-operative WTR and ATR astigmatism was 1.03 (1.13) D and 0.84 (0.77) respectively (p =0.57). On the 1st post-operative day induced astigmatism, the WTR and ATR was 4.46 (2.36) and 1.42 (1.14) respectively (p < 0.0001). On the 1st post-op day the WTR astigmatism was significantly high. On the 3rd week, the induced WTR and ATR was 1.40 (0.76) and 1.27 (0.99) respectively (p =0.69).

After 6 months, the mean WTR (SD) and ATR astigmatism was 1.08 (0.95) and 1.10 (0.88) respectively (p =0.97). At 6 months, the mean ATR astigmatism was higher than WTR but statistically was not significant.

**Table 3**

Mean (SD) decomposed vector measured by automated keratometry, preoperative and post operative (1st post op, 3rd weeks and 6 months) of 32 eye.

<table>
<thead>
<tr>
<th></th>
<th>WTR</th>
<th>ATR</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-op</td>
<td>1.03 (1.13)</td>
<td>0.84 (0.77)</td>
<td>0.57</td>
</tr>
<tr>
<td>1st post op</td>
<td>4.46 (2.36)</td>
<td>1.42 (1.14)</td>
<td>0.0001</td>
</tr>
<tr>
<td>3rd week</td>
<td>1.40 (0.76)</td>
<td>1.27 (0.99)</td>
<td>0.69</td>
</tr>
<tr>
<td>6. months</td>
<td>1.08 (0.95)</td>
<td>1.10 (0.88)</td>
<td>0.97</td>
</tr>
</tbody>
</table>
Discussion

Trabeculectomy has been shown to control IOP well in long term. Altered visual function induced by changes in corneal curvature following filtration surgery may be distressing to the patient, particularly when changes are marked and continue beyond the first few postoperative months. When measured by automated keratometry, the astigmatism induced in our study was significantly greater 2.73D (100 degree) only at the 1st post-op day which fastly decayed to minimum amount after 3rd week and 6 months (0.41D and 0.43D respectively). In this study we found high astigmatism at first post op day due tightly placed suture. Here we used 8-0 silk suture which has a property to loosen up with time so we practice to apply tight sutures intraoperatively to reduce the risk of post operative sclera flap leakage and shallow anterior chamber. Deep cautery also contribute to induced astigmatism. Regarding post operative bleb formation and IOP control we found there was well formed bleb and significant IOP control.

The first study to report the changes in corneal curvature following trabeculectomy was done by Hugkulstone (1991). He used an automated keratometer which recorded a mean induced with the rule astigmatic induction of 1 D at 7 weeks following a traditional sized procedure (5x5 mm scleral trap door) and sclera flap secured by use of 9/0 virgin silk suture in 10 eyes. He also notice an immediate initial corresponding increase in horizontal radius, but this is not apparent by two and seven week after surgery.

Claridge et al (1995) using the TMS system that they could identify three subgroups of eyes at 1 and 3 months postoperatively. The largest group had an induced superior steepening of the cornea resulting in a mean WTR astigmatism of about 1D (measured by polar values) which persisted to 1 year following surgery. These results were on eyes which had a 4x3 mm scleral trap door with two 10/0 nylon sutures.

Vernon et al (1999) reported in a study of small flap (2mm x 2mm sclera trap door and 0.75 mm internal sclerotomy) trabeculectomy procedure performed at the 90 degrees meridian on 16 eyes with the use of 10-0 nylon suture. By vector analysis, the mean surgically induced refractive changes (SIRC) in cylinder power vectors induced at 1, 3, 6, and 12 months as measured by manual keratometry were 0.68, 0.38, 0.52, and 0.55 dioptres, and by keratography 0.75, 0.66, 0.59, and 0.64 dioptres. Vector decomposition on the induced vector cylinders on manual keratometry resulted in a “with the rule” mean vector of 0.52 and 0.22 dioptres at 1 and 3 months and an “against the rule” mean vector of 0.16 and 0.16 dioptres at the same time points (p=0.03 and 0.28 respectively). The vector decomposition at 6 and 12 months revealed no significant with-the-rule changes. Similar analysis on the videokeratoscopy results revealed a significant induced with-the-rule astigmatism until 3 months, but not at 6 and 12 months postoperatively. In comparison, our study showed a high induced astigmatism only at first post op day but at 6th months the mean induced astigmatism was even less than that of micro trabeculectomy.

Cunliffe et al (1992) in a study on 16 eyes with manual keratometry utilising a slightly smaller scleral trap door (5x3 mm), found a significant WTR astigmatism up to 2 months but not at 10 months. Unfortunately, there were no intermediate analysis time points in this study.

Rosen et al (1992) used a 3x2 mm scleral trap door and 10/0 nylon suture. The mean vector power induced at 3 months in the study was 1.24 D which is more than what we achieved, 0.41D at just 3 weeks (p < 0.001).

Rosen et al (1992) found that five of the eight eyes studied developed between 1.5 and 2.5 D induced astigmatism at 3 months postoperatively when measured with the topographic modeling system (TMS).
A number of suggestions have been put forward to explain the WTR astigmatism induced by the trabeculectomy procedure. Hugkulstone (and later Dietze et al, 1997) mentioned the possibility of tight sutures and suggested a “posteriorly placed wound gape” from the internal sclerostomy as the cause. Cunliffe et al (1992) suggested that the internal sclerostomy allowed the corneal edge of the trabeculectomy to sink slightly thus decreasing the vertical radius of the cornea. Rosen et al (1992) considered that the cautery was the main factor as the induced astigmatism appeared to be greater when excessive cautery was used in one patient. Vernon et al (1998) suggested that the size of internal sclerostomy and amount of cautery play a main role in induced astigmatism.

**Conclusion**

Trabeculectomy with the use of 8/0 silk sutures showed significantly high 1st post-operative day SIA which nevertheless perished fast to minimum amount at just 3 weeks.

**References**


**Source of support: nil. Conflict of interest: none**
Comparison between limbal (von Noorden) and para limbal (Santiago) conjunctival incisions for adjustable recessions of horizontal recti

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²Sukriti Eye Clinic, Lucknow, India

Abstract

Introduction: Both limbal and para limbal conjunctival incisions are routinely used in strabismus surgery with comparable results however their outcome has not been compared while using adjustable sutures. Objective: To compare limbal (von Noorden) and para limbal (Santiago) conjunctival incisions for adjustable recessions of horizontal recti.

Subjects and methods: Uniocular adjustable recessions (with conventional non adjustable resection) in 24 appropriate patients were performed according to standard slip knot technique. The patients were assigned to the two groups after obtaining an informed consent using systematic randomization. Twelve patients in first group received the von Noorden incision with bare sclera closure and 12 in the second group received the Santiago’s modification of Swan incision with deferred closure. The surgeries were performed by a single surgeon and the adjustments performed after 24 hours. The incisions were studied on the established subjective (pain) and objective (hyperaemia, chemosis, discharge and gap in incision) variables at follow ups of 1st day post adjustment, 2 weeks and 12 weeks. Statistics: ‘Repeated Measures Anova’ test was used for statistical analysis. A p value <0.05 was considered statistically significant. Results: The limbal incision was superior to the paralimbal incision on both objective and subjective criteria by ‘Repeated Measures Anova’ test. Conclusion: We recommend using limbal incision and avoiding para limbal incisions while performing adjustable recessions.

Keywords: adjustable recession, conjunctival incision, horizontal rectus, strabismus

Introduction

Predominantly 3 incisions have been described for strabismus surgeries (Sami, 2007). Limbal (von Noorden, 2001) and para Limbal (Swan et al, 1954) are commonly used. Fornix incisions are also popular for better cosmesis but they are technically more challenging and require a well trained assistant (Park, 1968; Prakash et al, 1987). Various studies have been carried out comparing them with conflicting reports (Sami 2007 and Prakash et al, 1987). Several modifications for each technique have been recommended.

Adjustable surgeries although first reported over a century back have been popularized in our times by Jampolsky in 1975. Various advantages and indications have been described for the same (Morris et al, 1992; von Noorden, 2001 and Rosenbaum et al, 2001). It is also agreed by majority that adjustable recessions are more predictable and easier to perform than adjustable resections (von Noorden, 2001; Rosenbaum et al, 2001; Jampolsky, 1979; Metz, 1979) For this
reason where adjustable surgery is indicated we only perform adjustable recessions, preferring to do a conventional non adjustable resection. Adjustable surgeries have been described with all types of conjunctival incisions, probably depending on the comfort of the surgeon (Prakash et al, 1987, von Noorden, 2001; and Rosenbaum et al; 2001). We have routinely used limbal and paralimbal incisions (with single stage closure), (von Noorden, 1969; and Santiago et al, 1998) for over a decade with satisfactory outcomes in conventional non adjustable surgeries (Figure 1).

Here, we report a comparison between these techniques in adjustable recessions. A similar comparison for adjustable sutures has not been done to the best of our knowledge (pubmed and google search).

Subjects and methods
We performed uni ocular adjustable recessions (with conventional non adjustable resection) in 24 appropriatex patients according to standard described slip knot technique (Rosenbaum et al, 2001). The patients were allocated to the two groups after obtaining an informed consent using systematic randomization. Twelve patients in first group received the von Noorden incision with bare sclera closure and 12 in the second group received the Santiago’s modification of Swan incision with deferred closure (von Noorden, 1969; and Santiago et al, 1998) The surgeries were performed by a single surgeon (SA) and the adjustments performed after 24 hours. The incisions were studied on the established subjective (pain) and objective criteria (hyperaemia, chemosis, discharge and gap in incision) of a previous study at follow ups of 1st day post adjustment, 2 weeks and 12 weeks (Lee et al, 2011) Patient’s subjective discomfort was graded on a scale from 0 to 3 (0, total comfort; 1, minor discomfort; 2, moderate discomfort; 3, severe discomfort) (Apt et al, 1998; and Kim et al, 2003).

Modification of the revised facial pain scale was used for patient and parents ease (Lee et al, 2011; and Hicks et al, 2001). When a subjective determination of comfort was difficult to obtain in children, the parents were asked to provide an estimate. Using slit lamp biomicroscope, we graded the conjunctival inflammation in the recessed muscle quadrant using modified conjuntival inflammatory index (Alio et al 2003; and Ryu et al, 2005) (Table 1), in which hyperemia, chemosis and discharge were rated on a 0 to 3 scale (0, none; 1, mild; 2, moderate; 3, severe). Conjunctival incision healing was also investigated by measuring the largest gap size perpendicular to the incision line (in millimetres) using a slit lamp beam (Apt et al, 1998 and Kim et al, 2003).

Table 1: Conjunctival inflammation grades

<table>
<thead>
<tr>
<th>Statistic, Values</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conjunctival hyperemia</td>
<td>3 Hyperemia around the wounds and entire quadrant</td>
</tr>
<tr>
<td>Conjunctival discharge</td>
<td>3 Discharge on conjunctiva, cornea, and eyelid</td>
</tr>
<tr>
<td>Conjunctival chemosis</td>
<td>3 Chemosis around the wounds and entire quadrant</td>
</tr>
</tbody>
</table>

Statistical analysis
Statistical Analysis was performed on the 5 study factors (pain, hyperaemia, chemosis, discharge and gap in incision) using the ‘Repeated measures Anova’ test. As this test works best with spherical data we assessed sphericity of the data Huynh-Feldt method. The 12 week follow up data used for comparison between the groups. A p value of less than 0.05 was considered statistically significant.

Surgical technique
Patients selected for unilateral horizontal muscle recession-resection surgery and meeting the criteria for use of adjustable sutures underwent adjustable recession with conventional resection by standard technique under local anesthesia (von Noorden 2001; and Rosenbaum et al 2001). In the recessed muscle a slip knot suture was used which was adjusted after 24 hours of surgery under topical anesthesia. In first group the conjunctival incision was made about 2 mm from limbus with radial cuts ( von Noorden, 1969).This incision was given where the
conjunctiva and tenon capsule are fused and straight access to the sub-tenon space is achieved (Calhoun et al, 1987.) Marking sutures were used at the edges for easier identification at the end of the procedure (von Noorden, 2001). A buried knot 8-0 vicryl was used for single layered closure. Bare sclera technique with recession of conjunctiva was performed on the recession (adjustable) side to enable access to the muscle sutures (von Noorden et al 2001). In the second group the conjunctival incision was made approximately mid way between the muscle insertion and the limbus, and parallel to the muscle insertion (Santiago et al 1998). Access to the sub tenon space was achieved by cutting the tenon. On the resection side the tenon and conjunctiva were closed in separate layers by 8-0 vicryl with buried knots and on the adjustable recession side with a loop suture in 1 layer. The conjunctiva was retracted on the latter side after 24 hours for adjustment and the loop suture finally closed. Both groups were patched after surgery till adjustment and received no patching following adjustment. All patients received topical antibiotic –steroid combination eye drops 6 times a day for 2 weeks then 4 times a day for 2 weeks and twice daily for 2 more weeks.

**Figure 1:** Diagrammatic representation of the 2 incisions. Solid red line represents the Limbal (von Noorden) incision and the broken red line represents the paralimbal (Santiago) incision. The black circle and brown rectangle represent the cornea and horizontal rectus respectively. Note that the paralimbal incision is midway between the cornea and muscle insertion, running parallel to the insertion

**Results**
The mean age of the patients was 13.4 (range 9-32) years and 14.9 (range 10-37) years respectively. No complications occurred during the surgery or adjustment in any patient. The data at the 12 week follow up are shown in Tables 2 and 3. The data was spherical for all the study variables. A statistically significant difference (p< 0.001 with a favorable response to limbal incision) in observations was noted at 12 weeks for all study variables (pain, hyperaemia, chemosis & discharge) except gap in incision (p=0.457). The 12 week photographs of all patients are shown in Figures 2 & 3. Thus the limbal incisions were statistically and clinically superior to the paralimbal at 12 week follow up. Both incisions were comparable in terms of gap in incision. Two patients in the paralimbal group had to undergo excision of conjunctival cyst formed at the incision site at 12 weeks.

**Table 2: Patient data for limbal incisions at the 12 week follow up (for the score details see methods)**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Pain</th>
<th>Hyperaemia</th>
<th>Chemosis</th>
<th>Discharge</th>
<th>Incision</th>
<th>Gap</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td></td>
</tr>
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<td></td>
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<td></td>
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</tr>
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<td>0</td>
<td></td>
<td></td>
</tr>
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<td>7</td>
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<td>0</td>
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<td></td>
</tr>
<tr>
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<td>0</td>
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<td></td>
</tr>
</tbody>
</table>

**Table 3: Patient data for para limbal incisions at the 12 week follow up (for scoring details see methods)**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Pain</th>
<th>Hyperaemia</th>
<th>Chemosis</th>
<th>Discharge</th>
<th>Incision</th>
<th>Gap</th>
<th>Remarks</th>
</tr>
</thead>
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<td>2</td>
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<td>1</td>
<td>1</td>
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<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td>Conj Cyst</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
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<td></td>
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</tr>
</tbody>
</table>
Discussion

The von Noorden incision permits direct access to the sub tenon space because Tenon capsule and conjunctiva are fused into one layer close to the limbus (about 2 mm). (Calhoun et al 1987) Other advantages of limbal incisions are in re operations in which previous scarring has disrupted the normal anatomic planes that separate Tenon and conjunctiva, in operations in which conjunctival cicatrical changes are associated with restrictive strabismus- making conjunctival recession a consideration and in surgery in very elderly, in which conjunctiva has lost much of its normal elasticity (Sami, 2007; Cole et al; 1962) The disadvantages of limbal incisions include increased risk for irritation from conjunctival sutures, higher risk of conjunctival scarring within palpebral fissure, corneal dellen formation, possible loss of stem cells at limbus, interference with possible future trabeculectomy (from conjunctival scarring) besides the perceived difficulty in post operative adjustment because of incision being far from the muscle insertion (Sami, 2007; Tessler et al, 1975; and Holland et al, 1997). The originally described Swan method places the conjunctival incision behind the muscle insertion and parallel to the limbus (Swan et al, 1954). The conjunctiva is then dissected anteriorly and the Tenon capsule is opened just anterior to the muscle insertion and perpendicular to the conjunctival incision. The major advantages of this incision are its small size, the need for minimal dissection, better exposure and cosmesis in immediate postoperative period as the incision is hidden from the palpebral fissure area. Possibility of irritation, dellen formation etc are also minimal. The disadvantages are inability to perform adjustable procedures, possible injury to the muscle belly and ciliary vessels (Prakash et al, 1987). A modification of this incision recommended for adjustable sutures aims to take care of the latter complications but has possible disadvantages of the Limbal technique including risk of noticeable scarring (Swan, 1954, Santiago et al, 1998). This incision had been used by us.
We used the same conjunctival incision for resection as we did for recession in each group. We believe and it has also been reported that the two incisions in question are comparable in discomfort and healing (Sami 2007). Hence we safely attribute the difference in results to adjustable recessions. The fornix incision popularized by Park has many potential benefits including better cosmesis and lesser discomfort but is much larger, technically more demanding and requires a well trained assistant specially when combined with adjustable sutures (Parks 1968, Lingua et al and Prakash et al 1987.) Ours being a teaching institute, where postgraduates students assist, we do not use it in day to day practice.

Another popular incision is one described by Prakash located 3 mm from limbus. We find it no different from von Noorden incision in our experience (Prakash et al 1987). The difference in results of conjunctival closure between adjustable and non adjustable techniques may be attributed to the poorer approximation, reopening of adhesions, secondary suturing and larger amount of absorbable suture (hence foreign body reaction) used to anchor the muscle in adjustable technique. Conjunctival inflammation at the time of suture adjustment makes the secondary suturing painful and often less than satisfactory. Moreover we close the tenon separately from conjunctiva in the paralimbal incision when adjustments are not planned; however they were sutured together after adjustments. This less than ideal suturing could be contributory to poorer cosmesis and greater discomfort for the patient.

**Conclusion**

We recommend using limbal incision and avoiding para limbal incisions while performing adjustable suture strabismus surgery.

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Prevalence and determinants of xerophthalmia in rural children of Uttar Pradesh, India

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Abstract

Introduction: Vitamin A deficiency (VAD) is recognized as a major cause of blindness among children in India. Objective: To find out the prevalence of VAD in rural children of Uttar Pradesh, India. Materials and methods: This cross-sectional study was undertaken amongst children (0-15 years) in a rural area of Bareilly (Uttar Pradesh) where the study population was selected by simple random sampling out of villages under a Primary Health Centre. Out of 844 children, 802 participated in the study. The WHO classification of xerophthalmia was used. Results: Overall, the prevalence of xerophthalmia was 5.4 %. The prevalence of Bitot’s spots was 0.9 % in children under six years of age and 3.3 % in children above six years. The prevalence of xerophthalmia was significantly more in older children. Overall, the prevalence of anemia was found to be 11.8 % in the study population. A significantly high prevalence of xerophthalmia (OR= 5.7; 95 % CI = 2.8 - 11.5) was observed in children suffering from anemia. Conclusion: The presence of a milder manifestation of xerophthalmia and a 0.9 % prevalence of Bitot’s spot in children under six years of age in the present study shows a declining trend of VAD although it is still a public health problem. The higher prevalence in children above six years of age shows that apart from strengthening of Vitamin A prophylaxis programs, health education is needed for dietary diversification to include vegetables and fruits in the diet for long-term sustainability in improving the vitamin A status of children of all age groups.

Keywords: prevalence, rural children, xerophthalmia

Introduction

Vitamin A is needed in small amounts by humans for the normal functioning of the visual system and maintenance of epithelial cellular integrity. Vitamin A deficiency (VAD) can occur at any age; however, it is a disabling and potentially fatal condition for children under six years of age (Sommer, 1994). The prevalence of Bitot’s spots may be highest in the school age group but their occurrence may reflect the past history of VAD more than the current (Sommer, et al 1980). Studies have shown that VAD causes not only blindness but that it also has a profound impact on general morbidity, mortality and growth (Rahamathullaji, et al 1990). VAD is regarded as a public health problem if the prevalence of Bitot’s spots amongst children less than six years is 0.5 % or more (WHO1996). The vitamin A prophylaxis program was started in India in 1970 with the aim of preventing blindness due to vitamin A deficiency. The most comprehensive and recent
data shows that only 30% of children had received a dose of vitamin A (Indian Institute of Population Sciences, Mumbai 2000). The prevalence of Bitot’s spots (based on NNMB pooled data of seven states) was 1.8, 0.7 and 0.7 respectively, during the surveys carried out in 1975-79, 1988-90 and 1996-97. Individual studies carried out between 1950 to date revealed that the prevalence of vitamin A deficiency was 4% during the period up to 1980. There are a couple of studies on adolescents done in south India which indicate vitamin A deficiency as 0.8% to 1% (Singh & Toteja, 2003). Very few studied on VAD have included school children apart from pre-school children. Therefore, the present study was undertaken amongst children 0-15 years so as to estimate the prevalence of VAD in children of all age groups, in a rural area of Bareilly (Uttar Pradesh) and with the emphasis laid on biosocial factors.

Material and methods
The present cross-sectional study was undertaken in a rural area of Bareilly (Uttar Pradesh). The study area was selected by simple random sampling out of villages under a Primary Health Center. This rural area had a total of 844 children of 0-15 years. Out of these, 42 could not be included because of various reasons; hence, 802 children formed the study subjects. A house-to-house survey was carried out and information was obtained as per a predesigned pro forma. The information collected included the age, sex, residential address and the class in which the student was studying and the education, occupation, family size and income of the parents. The parents were inquired about night blindness. The history was accepted only when the response was definite. The standard methods and procedures for ophthalmic examination were used to detect xerophthalmia (Sommer, 1994)). Ocular examination was done by doctors with the help of a bright illuminant torch in natural light. The WHO classification of xerophthalmia was adopted in the study (WHO Technical Report Series No. 590, 1976). The WHO report has states that conjunctival xerosis (X1A) is not recommended for community diagnosis (Sommer, 1994). Because of these recommendations, conjunctival xerosis (X1A) only when accompanied by Bitot’s spots (X1B) has been included in the positive clinical signs of xerophthalmia in the data presented here. The socioeconomic status of the study subjects was estimated as per the modified Kuppuswamy socioeconomic scale (Mahajan & Gupta, 1995). This scale is based on three variables of the family: education, occupation of the head of the family and the total monthly income of family. Scores have been assigned to each of the different categories under these three variables and a combined score is used for grading the socioeconomic status. Hemoglobin estimation of all children was carried out and the cut-off point of 11 g/dl for children under six years and 12 g/dl for children above six years was considered for the diagnosis of anemia (Park, 2011). Children suffering from xerophthalmia were given 200,000 IU of Vitamin A orally for two days. The statistical analysis was carried out by the chi-square test and the odds ratio with its 95% confidence interval.

Results
Table 1 describes the prevalence of xerophthalmia according to age. The overall prevalence of xerophthalmia was found to be 5.4%. Only the milder manifestations of xerophthalmia, viz night blindness and Bitot’s spots, were observed. Not a single case of active corneal involvement was seen. The prevalence of xerophthalmia was found to increase with increasing age, reaching its maximum in the 13-15 year age group (11.6%). Though the prevalence of xerophthalmia was 5.4%, the overall prevalence of signs and symptoms was 4.4% as eight study subjects had more than one sign/symptom. The prevalence of Bitot’s spot was 0.9% in children under six years of age and 3.3% in children above six. The increase in the prevalence of xerophthalmia with the increase in age group was found to be statistically significant.
Table 1: Different manifestations of xerophthalmia, according to age

<table>
<thead>
<tr>
<th>Age-group (years)</th>
<th>Study subjects</th>
<th>Only Night blindness (XN only)</th>
<th>Only Bitot’s spots (XIB only)</th>
<th>Both XN and XIB</th>
<th>Total number with xerophthalmia</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 3</td>
<td>154</td>
<td>0 (0)</td>
<td>1 (0.6)</td>
<td>0 (0)</td>
<td>1 (0.6)</td>
</tr>
<tr>
<td>4 - 6</td>
<td>170</td>
<td>2 (1.2)</td>
<td>2 (1.2)</td>
<td>1 (0.5)</td>
<td>5 (2.9)</td>
</tr>
<tr>
<td>7 - 9</td>
<td>182</td>
<td>3 (1.6)</td>
<td>3 (1.6)</td>
<td>1 (0.5)</td>
<td>7 (3.8)</td>
</tr>
<tr>
<td>10 - 12</td>
<td>158</td>
<td>5 (3.2)</td>
<td>6 (3.8)</td>
<td>3 (1.9)</td>
<td>14 (8.9)</td>
</tr>
<tr>
<td>13 - 15</td>
<td>138</td>
<td>6 (4.3)</td>
<td>7 (5.1)</td>
<td>3 (2.2)</td>
<td>16 (11.6)</td>
</tr>
<tr>
<td>Total</td>
<td>802</td>
<td>16 (2.0)</td>
<td>19 (2.4)</td>
<td>8 (1.0)</td>
<td>43 (5.4)</td>
</tr>
</tbody>
</table>

Figures in parenthesis are percentages; $X^2 = 23.9; \text{ Df} = 4; \text{ P} = 0.001$

Table 2: Prevalence of xerophthalmia according to socio-demographic factors

<table>
<thead>
<tr>
<th>Factor</th>
<th>Study subjects</th>
<th>Xerophthalmia</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>445</td>
<td>27(6.1)</td>
<td>0.98</td>
</tr>
<tr>
<td>Female</td>
<td>357</td>
<td>16(4.5)</td>
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<tr>
<td>Socioeconomic status</td>
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<tr>
<td>Middle</td>
<td>275</td>
<td>11(4.0)</td>
<td>1.53</td>
</tr>
<tr>
<td>Lower</td>
<td>527</td>
<td>32(6.1)</td>
<td></td>
</tr>
<tr>
<td>Family Size</td>
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<td></td>
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<tr>
<td>Less than 5</td>
<td>425</td>
<td>21(4.9)</td>
<td>0.31</td>
</tr>
<tr>
<td>More than 5</td>
<td>377</td>
<td>22(5.8)</td>
<td></td>
</tr>
</tbody>
</table>

(Figures in parenthesis are percentages.)

Table 3: Distribution of xerophthalmia with anemia

<table>
<thead>
<tr>
<th>Anemia</th>
<th>With xerophthalmia</th>
<th>Without xerophthalmia</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>With Anemia</td>
<td>17 (17.9)</td>
<td>78 (82.1)</td>
<td>95 (11.8)</td>
</tr>
<tr>
<td>Without Anemia</td>
<td>26 (3.7)</td>
<td>681 (96.3)</td>
<td>707 (88.2)</td>
</tr>
<tr>
<td>Total</td>
<td>43 (5.4)</td>
<td>759 (94.6)</td>
<td>802 (100.0)</td>
</tr>
</tbody>
</table>

Figures in parenthesis are percentages; $X^2 = 30.6; \text{ P} = 0.00$ (Highly significant) OR = 5.71; 95 % CI = 2.8-11.5

Table 2 describes the prevalence of xerophthalmia according to sociodemographic factors. A higher prevalence of xerophthalmia was observed in boys, lower socioeconomic status and children with family size of five and above; however, the difference was not significant. The overall prevalence of anemia was in the study population 11.8 %. A high prevalence of xerophthalmia was observed in children suffering from anemia (Table 3). Estimates of odds ratios and their 95% confidence intervals confirmed significant association between xerophthalmia and anemia.

Discussion

Vitamin A deficiency has been long recognized as a major cause of blindness and an important public health problem among children in India. Although many studies have been conducted to assess the prevalence of xerophthalmia in different parts of the country, very few studies have included children of all age groups. The current study observed a 5.4 % prevalence of xerophthalmia in children up to 15 years. The earlier-conducted studies have reported a prevalence of xerophthalmia in the range of 1.1 % to 22.3 % in different population groups and in different parts of the country (Garg S, et al 1984; Sharma SK, et al 1985; Katiyar GP, et al 1986; Kartha GP, et al 1991; Sampathkumar V, et al 1993; Fakhir S, et al 1993; Chamani N, et al 1994; Pal R, et al 2008). The Garg study (Garg S, et al 1984) carried out in the rural area near Nagpur in central India estimated the prevalence of xerophthalmia to be 16.8 %, which is much higher than what we observed. The decrease in the prevalence may be due to the Vitamin A deficiency prophylaxis program. The prevalence of Bitot’s spots (0.9 %) in children under six years of age in this study is closer to the prevalence observed by NNMB (0.7 % pooled data of seven states) in 1996-97 and shows that VAD prevalence has declined over the years but that it is still a public health problem since the prevalence is more than the WHO guidelines (0.5 % in preschool children).

The presence of the milder manifestations of xerophthalmia shows that the prevalence of VAD is on the decline. In the present study, a significantly higher prevalence of VAD was found in the older age groups. Similar findings (Sharma SK, et al 1985; Fakhir S, et al 1993) are have also been reported by other investigators. The observed association between various the sociodemographic factors (lower socio-economic status and large family size) and xerophthalmia was also endorsed by the results.
of previous studies (Sharma SK, et al 1985
Katiyar GP, et al 1986). In the current study, the
prevalence of xerophthalmia was found more in
children suffering from anemia. This may be
because anemia is associated with a low intake
of nutrients and is generally associated with
various infections which further precipitate or
aggravate vitamin A deficiency.

Conclusion
The presence of milder manifestation of
xerophthalmia and a 0.9 % prevalence of Bitot’s
spots in children under six years of age in the present
study shows a declining trend of VAD but that it is
still a public health problem since the prevalence
exceeds the WHO guideline of 0.5 %. Health
education is needed for dietary diversification to
include vegetables and fruits for long-term
sustainability in improving the vitamin A status of
children of all age groups. Such an approach will
improve the intake of vitamin A and other
micronutrients in a balanced manner.

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WHO Technical Report Series No. 590, 1976
(Vitamin A Deficiency and Xerophthalmia Report
Corneal edema after phacoemulsification surgery in patients with type II diabetes mellitus

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Abstract

Introduction: Corneal edema delays early visual recovery after phacoemulsification surgery in diabetes mellitus. Objective: To compare corneal edema of eyes in patients with type II diabetes mellitus and in non-diabetics after phacoemulsification surgery. Materials and methods: A hospital-based, retrospective study involving 96 eyes that underwent phacoemulsification surgery for immature cataract at the Department of Ophthalmology, Kathmandu Medical College Teaching Hospital, Kathmandu, Nepal was carried out. Evaluation was performed of 33 eyes in patients with diabetes mellitus (diabetic group) and of 63 eyes in patients without diabetes mellitus (non-diabetic group). All diabetic patients had controlled blood glucose for at least one week prior to the surgery. The operated eye was examined before surgery and on one day, one week, and one month after surgery. Intraocular pressure was measured on each visit. Main outcome measures: The findings of post-operative corneal edema and visual acuity between the diabetic and non-diabetic groups were studied and compared. Results: There was no difference clinically in any pre-operative corneal examination between the diabetic and non-diabetic groups. The corneal edema after surgery was significantly higher in the diabetic group than in the non-diabetic group (p < 0.001). The number of patients with corneal edema one day and one week after surgery was significantly higher in the diabetic group than in the non-diabetic group (after 1 day, OR = 62.5; 95 % CI = 15.31 - 255.11, p < 0.000) and after 1 week, OR = 6.77; 95 % CI = 1.28 - 35.76, p < 0.006) Conclusion: Corneal edema following phacoemulsification surgery in diabetic eyes is likely to be more frequent than in non-diabetic eyes.

Key words: diabetes mellitus, phacoemulsification surgery, corneal edema

Introduction

The prevalence of type II diabetes mellitus is increasing in Nepal (White F et al 2002). Patients with diabetes mellitus develop cataract at an earlier age than non-diabetics do (Nielsen et al1984). Phacoemulsification is an ideal technique for diabetic cataract. Phacoemulsification had an advantage over previous cataract surgical procedures because of the quick recovery of vision (Zheng L et al 1997) and the less post-operative inflammation (Laurell CG et al 1997). Transient corneal edema is a common post-operative complication following phacoemulsification (Junejo SA et al 1999). Based on the slit-lamp examination findings, corneal edema is defined as an increase in the central corneal thickness (Lundberg B et al 2005) with or without descemet folds. The OCTET graded corneal edema as transient corneal edema, transient corneal edema with descemet membrane folds of < 10, and transient corneal edema with descemet membrane fold sof > 10. Diabetic corneas do not recover from

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edema as quickly as normal corneas because of
the decreased regulation of fluid balance,
enzymatic dysfunction of bicarbonate pump,
and involvement of aldose reductase with build-
up of sorbitol in the corneal stroma. Endothelial
cell loss and fragility lead to impaired barrier
function (Morikubo S et al 2004). The present
retrospective study was undertaken to evaluate
the corneal edema of phacoemulsification
cataract surgery in a type II diabetic group and
in a non diabetic group.

Materials and methods
A hospital-based, retrospective study involving
96 eyes that underwent phacoemulsification
surgery for immature cataract at the Department
of Ophthalmology, Kathmandu Medical College
Teaching Hospital, Kathmandu, Nepal was
carried out. Evaluation was performed of 33 eyes
in patients with type II diabetes mellitus (diabetic
group) and of 63 eyes in patients without diabetes
mellitus (non-diabetic group). The operated eye
was examined before surgery and after one day,
one week, and one month after surgery. Immature
cataract was defined as nucleus sclerosis up to
2 +, cortical cataract 2 + and posterior sub-
capsular cataract of any grade. The study was
carried out to compare corneal edema after
phacoemulsification surgery of eyes in patients
with and without type II diabetes mellitus.

Patients having immature cataract that had
undergone uneventful phacoemulsification were
selected for the study, and those with corneal
pathology, ocular hypertension, glaucoma,
uveitis, small pupil and intra-operative
complications were excluded.

An informed consent was obtained from every
subject before enrollment in the study. Ethical
clearance was obtained from the institutional
research committee.

All the diabetic patients had controlled blood
sugar since one week prior to the surgery.
Initial screening examinations consisted of
uncorrected visual acuity (UCVA), pinhole visual
acuity, pupil and slit-lamp examination with
Haag Streit 900, fundus examination under
mydriasis (FEUM) with 90 D and 20 D,
 intraocular pressure measurement, blood glucose
measurement and blood pressure measurement.
In the slit-lamp examination, corneal edema was
defined as an increase in the central corneal
thickness (Lundberg B et al 2005) with or without
descemet folds. The intraocular pressure was
found to be normal throughout the study in all the
cases. Biometry was performed before the
operation on all patients with the use of a
keratometer and a A scan (Tomey) for the axial
length calculations and determination of the IOL
power. All patients were advised to install
Ofloxacin eye drop four times/day one day prior
to surgery. A peri-bulbar block was administered
and a balanced weight applied to soften the eye.
The patients were brought to the operating room
where the eye was painted with betadine and
draped for cataract surgery.

Surgical method
All surgeries were performed by a single surgeon
(KS).

The clear corneal tunnel incision was fashioned.
A continuous curvilinear capsulorhexis was
performed under a viscoelastic material
(HPMC). The lens nucleus was mobilized using
a balanced salt solution and a blunt hydro-
dissection cannula. Phacoemulsification was
performed using the Oertli (Catarhex)
phacoemulsifier with the phaco chop and
endocapsular techniques by a operating
microscope, CarlZeiss-S7. A TECCHFOLD
foldable acrylic IOL with a 6 mm
phacoemulsification lens (Flex) was inserted
under the viscoelastic material through a 3 mm
opening. The viscoelastic material was aspirated.
The wound was hydrated and an approximate
physiological intraocular pressure was restored
with a balanced salt solution injection through a
side port. An intra-cameral injection of
cefuroxime 1mg was given at the conclusion of
the surgery. A pad was then placed over the eye.
No ocular antihypertensive agents were used.

Follow up
All the patients had their dressing removed and
eye cleaned on the first post-operative day. They
were examined unaided and with a pinhole
internal illuminated Snellen visual acuity chart. The intraocular pressure was recorded by Goldmann applanation tonometry. The wound integrity, corneal edema grading according to OCTET, anterior chamber activity, and lens position were also noted. A set post-operative prescription of ofloxacin 0.3 % eye drops four times daily and prednisolone acetate 1 % eye drops six times daily was given to all the patients. All the patients’ appointment was made for one week and one month after surgery. A complete ocular examination including refraction was done on each of these visits. The topical steroid, in a tapering dose, and the antibiotic was prescribed for a total of four 4 weeks.

**Statistics**

The SPSS version 14.0 was used for data analysis. A value of p < 0.05 was considered significant. A statistician was consulted as and when necessary.

**Results**

In this study, 96 eyes (63 non-diabetes and 33 type 2 diabetes) were enrolled. The mean age of the patients was 67 +/- 11.22 years (Table1). The laterality was 57 right eye 39 left. Among the type 2 diabetes patients, 23 eyes had no diabetic retinopathy and eight eyes had mild NPDR and two moderate NPDR. Of all the patients, 7% were both diabetic and hypertensive while 26% were only hypertensive. The mean IOP throughout the study was 16 +/- 2 mm Hg in all cases. The mean phaco time was 7.81 +/- 4.01. The phaco time was not significant for corneal edema between the diabetic and non-diabetic groups (p < 0.07).

Clinically, no significant differences in any pre-operative corneal examination findings were observed between the diabetic and non-diabetic groups. The corneal edema after surgery was significantly higher in the diabetic group than in the non-diabetic group (p < 0.000). The corneal edema on the first post-operative day and one week after surgery was significantly higher in the diabetic group than in the non-diabetic group; after one day, the odds ratio was 62.5, 95%; CI 15.31 - 255.11; p < 0.000; and after one week, the odds ratio was 6.77, 95%; CI 1.28 - 35.76; p < 0.006.

**Table 2: Corneal edema on the first post-operative day**

<table>
<thead>
<tr>
<th>Diabetes (n)</th>
<th>Corneal edema (n)</th>
<th>Total</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Present</td>
<td>absent</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>25(75.8%)</td>
<td>8(24.2%)</td>
<td>33</td>
</tr>
<tr>
<td>No</td>
<td>3(4.8%)</td>
<td>60(95.2%)</td>
<td>63</td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
<td>68</td>
<td>96</td>
</tr>
</tbody>
</table>

**Table 3: Corneal edema grading**

<table>
<thead>
<tr>
<th>Diabetes (n)</th>
<th>Transient corneal edema</th>
<th>Transient corneal edema Descemet folds &lt;10</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>19(57.7%)</td>
<td>6(18.1%)</td>
<td>25(75.8%)</td>
</tr>
<tr>
<td>No</td>
<td>1(1.6%)</td>
<td>2(3.2%)</td>
<td>3(4.8%)</td>
</tr>
<tr>
<td>Total</td>
<td>20(59.3%)</td>
<td>8(21.3%)</td>
<td>28</td>
</tr>
</tbody>
</table>

**Table 4: Corneal edema on the 7th postoperative day**

<table>
<thead>
<tr>
<th>Diabetes (n)</th>
<th>Corneal edema (n)</th>
<th>Total</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Transient corneal edema</td>
<td>absent</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>6(18.2%)</td>
<td>27(81.8%)</td>
<td>33</td>
</tr>
<tr>
<td>No</td>
<td>2(3.2%)</td>
<td>61(96.8%)</td>
<td>63</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>88</td>
<td>96</td>
</tr>
</tbody>
</table>

On the first post-operative day, the non-diabetic group had a better UCVA (6/6 to 6/12 = 98.5%) than the diabetic group (6/6 to 6/12 = 87%); and as the transient corneal edema was recovered after one week, both groups had a similar visual acuity.
Table 5: Post-operative visual acuity among the non-diabetics and the diabetics

<table>
<thead>
<tr>
<th></th>
<th>UCVA 4/6 (n=63)</th>
<th>UCVA 4/9 (n=63)</th>
<th>UCVA 4/12 (n=63)</th>
<th>UCVA 4/18 (n=63)</th>
<th>UCVA 4/24 (n=63)</th>
<th>UCVA 4/36 (n=63)</th>
<th>UCVA 4/60 (n=63)</th>
<th>UCVA &lt;6/60 (n=63)</th>
<th>Total (n=96)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NoDM</td>
<td>54% (34)</td>
<td>36.5% (23)</td>
<td>8% (5)</td>
<td>10% (3)</td>
<td>1.5% (1)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>54% (34)</td>
</tr>
<tr>
<td>DM</td>
<td>15% (5)</td>
<td>42% (14)</td>
<td>30% (10)</td>
<td>30% (10)</td>
<td>30% (10)</td>
<td>30% (10)</td>
<td>30% (10)</td>
<td>30% (10)</td>
<td>15% (5)</td>
</tr>
<tr>
<td>Total</td>
<td>69% (39)</td>
<td>78.5% (37)</td>
<td>38% (15)</td>
<td>40% (13)</td>
<td>31.5% (11)</td>
<td>30% (10)</td>
<td>30% (10)</td>
<td>30% (10)</td>
<td>69% (39)</td>
</tr>
</tbody>
</table>

After four weeks post-operative, 48% had uncorrected visual acuity of 6/6 and the remaining 52% had the following causes for uncorrected visual acuity of less than 6/6.

Table 6

<table>
<thead>
<tr>
<th>Causes of decrease vision less than 6/6</th>
<th>Non diabetes (n=63)</th>
<th>Diabetes (n=33)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refractive error</td>
<td>15% (19)</td>
<td>9% (13)</td>
<td>24% (32)</td>
</tr>
<tr>
<td>AMD</td>
<td>14% (9)</td>
<td>0</td>
<td>14% (9)</td>
</tr>
<tr>
<td>Diabetic maculopathy</td>
<td>0</td>
<td>27% (9)</td>
<td>27% (9)</td>
</tr>
<tr>
<td>Total</td>
<td>(28)</td>
<td>(21)</td>
<td>(49)</td>
</tr>
</tbody>
</table>

Discussion

Patients with diabetes mellitus develop cataract at an earlier age than non-diabetics do. Phacoemulsification is an ideal technique for diabetic cataract. Phacoemulsification has an advantage over previous cataract surgical procedures because of the quick recovery of vision and the less post-operative inflammation. Transient corneal edema is a common post-operative complication following phacoemulsification.

In this study, the corneal edema after surgery was significantly higher in the diabetic group than in the non-diabetic group (p < 0.000). The corneal edema at one day and one week after surgery was significantly higher in the diabetic group than in the non-diabetic (after one day, the odds ratio was 62.5, 95%; CI 15.31 - 255.11; p < 0.000; and after one week, the odds ratio was 6.77, 95%; CI 1.28 - 35.76; p < 0.006). Similarly, S Morikubo et al found that the corneal endothelial cell losses one day and one week after surgery were significantly higher in the diabetic group than in the non-diabetic group (after one day, P =.03; and after one week, P =.04), thereby delaying the post-operative recovery of corneal edema (Morikubo S et al, 2004). R J Antcliff et al also found that there was an increased incidence of transient corneal edema post-operative complications in the phacoemulsification group of diabetics (Antcliff R J et al, 1996). S A Junejo et al concluded that corneal edema cleared within one to two weeks (Junejo SA et al, 1999). The outcome of cataract surgery in diabetics is largely determined by the degree of maculopathy(Lundberg B et al, 2005).

After four weeks post-operative, 67.7% of the patients had a visual acuity of 6/6 and the remaining 32.3% had a visual acuity of less than 6/6. Among the diabetics, 27% had impairment of vision after four weeks due to diabetic maculopathy. Antcliff et al concluded that the outcome of cataract surgery in diabetics is largely determined by the degree of maculopathy (Antcliff R J et al, 1996). Anna Zaczek et al at St Erik’s Eye Hospital, Karolinska Institutet, Stockholm, Sweden found that the VA of 46 diabetic eyes (88%) improved one year after surgery and that of only six eyes (12%) was unchanged or worse. Forty-one diabetic eyes (79%) achieved a VA of 0.5 or better and 11 eyes (21%) had a final VA of lower than 0.5. They concluded that the final visual outcome was improved in the majority of diabetic eyes. Eyes with CSMO (clinically significant macular edema) at the time of surgery had the worst prognosis regarding postoperative VA (Zaczek A et al, 1999).

Conclusion

Corneal edema following phacoemulsification surgery in diabetic eyes occurs more frequently than in non-diabetic eyes.

References


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Outcome of the patients with post-operative cluster endophthalmitis referred to a tertiary level eye care center in Nepal

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BP Koirala Lion’s Center for Ophthalmic Studies, Institute of Medicine, Kathmandu, Nepal

Abstract

Introduction: The causative organism and treatment outcomes of post operative endophthalmitis may vary depending on several factors. Objective: To find out the causative organisms and visual outcome after an outbreak of post-operative endophthalmitis. Materials and methods: An interventional prospective series of cases of clinically suspected endophthalmitis was studied. Eleven patients who presented within 48 hours after manual cataract surgery on the same day, by a one surgeon in a single center were enrolled in the study. They underwent both anterior chamber and vitreous aspiration and all of them received intravitreal Vancomycin, Amikacin and Dexamethasone. Samples were subjected to microbiological evaluation. All patients were followed up till 8 weeks for clinical and visual outcome. Results: Of the 11 eyes of suspected endophthalmitis, only one vitreous aspiration showed Gram negative bacilli on Gram stain and 3 vitreous aspirates showed Gram positive cocci. Of the 11 eyes, 3(42.85%) had culture positive on vitreous aspirate. In 2 cases E Coli was isolated and in 1 Staphylococcus aureus was isolated. After 48 hours of intravitreal injection, 10 out of 11 eyes improved and in one, intravitreal injection of vancomycin, amikacin and dexamethasone was repeated. The best corrected visual acuity of 6/9 was achieved in 2 patients, 5 had 6/18, 2 had 6/60 and 2 had 5/60 at the end of eight weeks. Conclusion: Staphylococcus aureus and E coli can cause endophthalmitis immediately on the first day post-operatively. Clinically suspected endophthalmitis treated with antibiotics and steroid intravitreal injection can result in better visual outcome.

Keywords: cataract surgery, endophthalmitis, postoperative

Introduction

Cataract surgery is one of the most frequently performed intraocular surgeries in the world. 90% of postoperative endophthalmitis is seen following cataract surgery (Verbraeken 1995). Post-operative endophthalmitis after cataract surgery, though rare, is still reported (Kehdi et al, 2005). The incidence of postcataract surgery endophthalmitis varies, ranging from <0.05% to >0.3% (Al-Mezaine et al, 2009; West et al 2005; Ravindran et al, 2009). Postoperative endophthalmitis after cataract surgery is damaging, because it can lead to permanent vision loss and loss of the eye (Aaberg et al, 1998; Choi et al, 2011). Cluster endophthalmitis can be defined as five or more cases of endophthalmitis occurring on a particular day in a single operating room in one centre (Bajimaya et al, 2010). The present study was carried out to determine the outcome of promptly diagnosed and treated cases of cluster endophthalmitis.
Materials and methods
A prospective interventional study with the intention to treat was carried out on cluster endophthalmitis patients. These patients were referred to BP Koirala Lions Centre of Ophthalmic Studies (BPKLCOS) from a collaborative eye clinic on May 2012. Total of 11 patients, operated on the same day by a single surgeon from one center were enrolled. A detailed history including the findings of clinical examination at presentation was recorded. The types of surgical procedure performed and events during surgery if any were reviewed from the clinical case sheets from the collaborative eye clinic. Communication with the involved surgeon and the staff was done. Predisposing factors attributed to the patient like high blood sugar, poor lid hygiene and to the surgeon like irregular wound construction and wound leak if present were also recorded. Acute post cataract surgery endophthalmitis was diagnosed clinically and based on posterior-segment ultrasonography. Diagnosis of endophthalmitis was made on the basis of symptoms of profound pain, redness and decreased visual acuity, and signs of hypopyon and/or vitreous clouding and absence of severe corneal edema on slit lamp bio-microscopy. Intraocular pressure (IOP) was also recorded. Ultrasonography of the eye was done in all cases to assess the extent and location of vitreous involvement and rule out retinal detachment and choroidal detachment. On ultrasonography, all of the eyes had echo dense opacities persisting on low gain in anterior and mid vitreous. Toxic anterior segment syndrome was considered as differential diagnosis as presentation was within 48 hours of surgery. However, a remote possibility cannot be completely ruled out. The test for Endotoxins was not possible in our set up. All the cases were managed as per Endophthalmitis Vitrectomy Study (EVIS) 1995. They received intravitreal antibiotics and steroid since all patients presented within 48 hours with clinical signs and symptoms of acute postoperative endophthalmitis and visual acuity of hand movement or better. Both aqueous and vitreous samples for microbiological evaluation were collected at the beginning, before injection of intravitreal antibiotics in all cases. With full aseptic precautions, under peribulbar anesthesia, vitreous tap was performed in the isolated community operation room. A vitreous sample (0.2 to 0.3 ml) was obtained by a 25 gaue needle aspiration 3.5 mm posterior to limbus at the superior-temporal pars plana area. Intravitreal antibiotics and steroid were injected empirically at the end of anterior chamber and vitreous aspiration sampling. The vitreous samples were sent to microbiology laboratory at BPKLCOS and were subjected for Gram staining, Giemsa staining, KOH wet preparation, and culture and sensitivity test using the culture media: chocolate agar, brain heart infusion and Sabouraud’s dextrose agar. Anterior and posterior segment evaluations were done by a general ophthalmologist and a vitreo-retinal surgeon as well. Intravitreal antibiotics were a combination of Vancomycin (1 mg/0.1 ml), Amikacin (0.4 mg/0.1 ml) and Dexamethasone (0.4 mg/0.1 ml). Six hours after intravitreal injection, all patients received topical medication. Prednisolone acetate 1% one hourly which was tapered off weekly along with Ofloxacin 0.3% 2 hourly and Tropicamide 1% 8 hourly were given.. Oral Ciprofloxacine 750 mg 12 hourly for 5 days, as it is a beneficial adjunctive therapy (Morlet et al, 2000), and Prednisolone 40 mg for 7 days after intravitreal aspirate and antibiotics were also added. Visual acuity testing, anterior segment biomicroscopy and fundus examinations were performed on the next day in the morning. Good visual outcome was defined as visual acuity of 6/60 or better at the final follow-up (Carrim et al, 2009).

Results
Of the eleven eyes in the study, 8 eyes were right eye (73%) and 3(27%)were left. There were 6 male and 5 female patients. Ages ranged from 35 to 79 years. The mean age was 57 years (SD ±12.19). The median age was also 57 years and the mode age was 60 years. All the patients had a normal
blood sugar level preoperatively and were put on Ofloxacin eye drops 8 hourly on the eye undergoing operation 3 days prior to surgery.

Manual Small incision cataract surgery (SICS) with posterior chamber IOL was done in 10 and conventional ECCE with IOL in 1 case on a single day. Of the eleven patients, ten patients had uneventful intra-operative period, and the conventional ECCE case had posterior capsule rent with no vitreous loss. The wound construction was regular. To ensure leak proof wound, the wound was checked with a dry swab for leakage. In two Manual SICS cases interrupted sutures were placed as there was wound leak. All patients developed the features of endophthalmitis (symptoms of profound pain and redness poor visual acuity and signs of cells and flare in anterior chamber, hypopyon, corneal edema, and absent red reflex) within 48 hours of surgery. Hypopyon of 0.5 to 1.5 mm were seen in all 11 eyes. Ten eyes had an average of 0.5mm hypopyon. One eye had 1mm and one eye had 1.5mm hypopyon. In two of them hypopyon was mixed with hyphema. The mean time of presentation was 36 hours (SD±9.29 hours). However these patients had no marked lid edema or chemosis. Corneal edema was minimal; none had limbus to limbus corneal edema. Severe pain was the single most common complaint of all these patients. Six patients presented with severe painful diminution of vision and five with severe painful diminution of vision as well as photophobia. Eight eyes had hypopyon on 1st post operative day (POD) with painful diminution of vision and absent red reflex. Diminution of vision was marked but none had less than HM. Three eyes had pain, marked reaction but good fundal glow on the 1st POD but they presented with painful diminution of vision and absent red reflex on the 2nd POD (1/60 and above vision).

Table 1: Visual Acuity at Presentation

<table>
<thead>
<tr>
<th>Presenting Visual Acuity</th>
<th>No. of Patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand movement</td>
<td>5(46%)</td>
</tr>
<tr>
<td>1/60-3/60</td>
<td>4(36%)</td>
</tr>
<tr>
<td>6/60-6/36</td>
<td>2(18%)</td>
</tr>
</tbody>
</table>

On ocular ultrasonography, all of the 11 eyes had echo reflective vitreous opacities persisting on low gain in the anterior and mid vitreous. All of the eleven eyes had normal IOP. The mean IOP was 14 mmHg (SD ±2.58).

Figure 1: Clinical photograph of ultrasonography of one of the affected eyes which shows echodense opacities in the vitreous in both high and low gain.

All the patients were taken to operation theatre and painting was done with 10% betadine solution After peribular block, under full aseptic measures anterior chamber and vitreous aspirate samples were taken. Surgical wounds were inspected. None of the patients had wound dehiscence. Of the 11 eyes, vitreous aspiration was turbid in eight eyes and two had clear but straw colored aspirate. The samples were subjected to microbiological study.

Only one vitreous aspiration showed Gram negative bacilli on Gram stain. 3 vitreous aspirates showed Gram positive cocci. Of the 11 eyes, 3 were culture positive on vitreous aspiration and t 8 were culture negative. In 2 cases E Coli and in 1 Staphylococcus aureus were isolated. The isolates were sensitive to Vancomycin, Amikacin, Ofloxacin and Chloramphenicol only. Gram stain and culture from anterior chamber aspirates were negative for both Gram stain and growth in culture media. The collaborative eye clinic was contacted and asked to get the batch of trypban blue, viscoelastic substances and ringer lactates used at the time of surgery to the BPKLCOS laboratory. There was no growth of organisms on culture of these samples. Flushing from tubing and Simcooe irrigation aspiration cannula could not be retrieved to send for culture.
As per the EVS 1995 injection regimen, all of them received intravitreal antibiotics and steroid. Eight patients presented on the first POD. Three patients presented within 24 hours of operation, five presented within 36 hours of operation and three presented on the 2nd POD, that is within 48 hours of operation. They were given intravitreal Vancomycin 1 mg, Amikacin 0.4 mg and Dexamethasone 1mg along with subconjunctival Vancomycin and Dexamethasone on the same day of presentation.

After 48 hours of intervention, 10 out of 11 eyes improved symptomatically as well as clinically and in 1 intravitreal injection of Vancomycin, Amikacin and Dexamethasone were repeated. Almost all of the patients felt marked decrease of intensity of pain after 24 hours of intravitreal antibiotics and steroid. They were reevaluated on slit lamp biomicroscope on the next day of the intravitreal injection and the hypopyon almost cleared in 9 and was present in trace amount in 2 cases. Good fundal reflex was present in all 11 eyes. They were started on topical antibiotic and steroid and tropicamide 1% after 6 hours of intravitreal injection.

Among the 11 eyes, 3 eyes developed posterior capsular opacification. Almost all of the eyes had a minimal anterior chamber reaction at the end of 8 weeks. 2 had significant opacities in the vitreous also. The best corrected visual acuity of 6/9 was present in 2 patients with minimal anterior chamber reaction and minimal vitreous opacities, 5 had 6/18 with mild to moderate vitreous opacities and early PCO, 2 had 6/60 with moderate vitreous opacities and early PCO and 2 had 5/60 visual acuity with significant vitreous opacities and early PCO. Nine (81.81%) out of 11 eyes had good visual outcome.

The patients were followed up for 8 weeks. 2 patients were lost for follow up after 6 weeks as they were from distant places and when contacted declined to be followed up.

**Discussion**

This study attempted to look at the factors responsible for endophthalmitis like features on the first post-operative day. Those factors included uncontrolled blood sugar, poor lid hygiene, irregular wound, wound leak and contaminated batch of operative materials. The outcome was analyzed based mainly on clinical improvement as well as visual acuity at the end of study in a suspected cluster of endophthalmitis in our setup.

Postoperative endophthalmitis poses a significant public health issue as millions of people have cataract surgery each year (Javitt al, 1995, Leaming 2003). Incidence of endophthalmitis has been declining in the past several decades due to improved surgical techniques, sterilization methods and better postoperative care and use of broad-spectrum antibiotics (Ram et al, 2001). Despite these measures, cluster of cases of endophthalmitis can occur after cataract surgery and has been reported (Zaluski et al, 1999).

Source of infection could not be evaluated in our series as the patients were referred from a distant collaborative eye clinic where microbiological facilities were not present. On communication with the collaborative eye clinic it was found that patients wore unsterile hospital gowns over their own clothes,
whereas feet and head were left uncovered. In the preoperative room, the periciliar skin was cleaned with 10% povidone-iodine solution before giving retrobulbar block. Reusable, sterile cotton drape was used to cover the surgical field. The surgeon and assistant had scrubbed with povidone iodine (7.5%) for 8 minutes and wore sterile gown and gloves. The surgeon had changed fresh gloves after 5 cases and in between each case used 70% isopropyl alcohol. The batch of tryphan blue, viscoelastics and ringer lactate used at time of surgery were brought to BPKLCOs laboratory. They were sent for culture. They yielded no organisms. Test for Endotoxins was not done due to unavailability.

Factors associated with cluster endophthalmitis in the medical literature are poor sterilization technique and operation room hygiene, contaminated irrigating solutions, viscoelastics, improper ventilation system (Hughes et al 1994, Hasan 1994, Egger et al, 1994). There are no definite data with regard to these factors. The infective agents could have been introduced into the eye at the time of intraocular surgery (Walker et al, 1986). It has been thought that the patient’s own conjunctival flora could be the most common source of infection (Speaker et al, 1991).

A failure to achieve perfect sterility of the surgical field may, in all probability, have played a role in development of these infections (Swaddiwudhipong et al, 1995). It is necessary to find out the culprit organism as part of the management. In our study Escherichia coli and Staphylococcus aureus were isolated on culture. Culture positive cases were only 3 in number. Ultra-sonographic findings of the affected eye supported the clinical suspicion of acute infective endophthalmitis. However, toxic anterior segment syndrome could not be completely ruled out in the remaining 8 cases as endotoxin test could not be done. However, the follow up findings of persistent vitreous opacities in all cases in minimal to significant amount also goes in favor of endophthalmitis of.

The right eye was affected in two-thirds of our cases. This finding was consistent with studies from Nepal (Bajimaya et al 2010; Thapa et al 2011). In our study, the mean age of our patients was 57 years which was similar to other studies (Bajimaya et al 2010; Thapa et al 2011). Male and female were almost equal (6 male, 5 female) in our study. This finding is contradicting with the findings of other studies (Bajimaya et al, 2010; Malhotra et al, 2008; Thapa et al, 2011). Mean time of presentation was 36 hours. Therefore, toxic anterior segment syndrome was also considered as a differential diagnosis. On the basis of typical clinical findings and judgment and ocular ultrasonography findings acute endophthalmitis was diagnosed which was supported by microbiological evidence. Fungal endophthalmitis was not suspected as it is less common in acute cases (Fox et al, 1991). Therefore, all the cases were treated empirically with vancomycin (1 mg/0.1 mL) owing to its broad coverage of Gram-positive bacteria and amikacin (0.4 mg/0.1 ml) owing to its Gram negative coverage and dexamethasone (0.4 mg/0.1 ml) intravitreal injection.

Only one vitreous aspiration shows Gram negative bacilli on Gram stain report and 3 vitreous aspirates showed Gram positive cocci. Of the 11 eyes, 3 had culture positive on vitreous aspiration. In 2 cases, E Coli was isolated and in 1 Staphylococcus aureus was isolated. In a study done in India to evaluate organisms in 3 clusters with total of 24 patients, smears were positive for Gram-negative bacteria in 14 (58%) vitreous samples and cultures grew Pseudomonas aeruginosa in 10 (42%) of 24 samples (Malhotra et al 2008). In another study done in India (Anand et al, 2000) among 170 cases, 71 (41.7%) were attributable to Gram-negative, 64 (37.6%) to Gram-positive bacteria, and 37 (21.8%) to fungi. E coli and Staphylococcus aureus were the isolates in the vitreous culture of our patients, and we didn’t find any multiple pathogens and a predominance of a pathogenic organism. This is on a par with study done by Thapa et al (2011).
Early diagnosis and timely management with intravitreal medications with or without Pars Plana Vitrectomy (PPV) is the treatment of choice for postoperative endophthalmitis depending on the severity (EVS 1995). Eight out of 11 presented to us on 1st post operative day and the rest presented on the 2nd and 3rd postoperative day. All received intravitreal antibiotics immediately after clinical evaluation and ocular ultrasonography.

All our patients responded to medical therapy without the need for vitrectomy. Only one patient who received repeat intravitreal antibiotics also improved over 72 hours both clinically as well as in terms of visual acuity.

Timely detection, communication with the collaborative clinic, evaluation and intervention were the crucial factors for the response. In a study done by Malhotra et al (2008), PPV with intraocular antibiotics and steroid was performed in all the patients of the three clusters. Good visual outcome (Better than or equal to 6/60) was seen in our case series, 9 (81.81%) out of 11 eyes had good visual outcome. This is due to early presentation within the same day of suspicion of endophthalmitis and our preparedness for a detailed examination and essential intervention. This is on par with the study done by Bajimaya et al (2010) and Carrim et al (2009). About 74% (14/19) of their patients had achieved best corrected visual acuity better than or equal to 6/60.

Limitation of our study was that the follow-up period was short. Long term outcome could not be determined as the patient did not turn up for follow up either as they were from distant places and many of them were farmers who were busy in rice planting at that time. We could not evaluate the collaborative eye clinic for focus of infection.

Conclusion
Staphylococcus aureus and E coli can cause endophthalmitis immediately on the first day post-operatively. Clinically suspected endophthalmitis treated with antibiotics and steroid intravitreal injection can result in better visual outcome. Intravitreal antibiotics and steroid along with the sub-conjunctival vancomycin are effective in the treatment of an outbreak of endophthalmitis.

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References


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Calcium carbide related ocular burn injuries during mango ripening season of West Bengal, eastern India

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Abstract

Introduction: Calcium carbide used in fruit ripening industry as a cheap alternative to natural plant hormone ethylene produces highly inflammable acetylene gas. Inadvertent ignition of this gas can cause severe ocular burn injury with unilateral or bilateral blindness. Objective: To determine the characteristics and visual outcome of ocular burn injuries from calcium carbide during mango ripening season of West Bengal, eastern India. Materials and methods: A prospective study of all cases of calcium carbide related ocular burn injury attending a tertiary care hospital during mango ripening season was carried out. The demographic features, characteristics of the injury, management and outcomes were recorded. Results: Fifty five eyes of 33 patients were studied. Males were more commonly affected (20 patients, 60.6%) than females. The injury was bilateral in 22 patients (66.66%). Seventeen patients (51.51%) were below 20 years of age. Ten eyes had open globe injuries and 45 eyes had closed globe injuries. One eye of a patient had to be enucleated (3%). Children below 14 years of age were mainly injured while playing with indigenous fireworks of shooting carbide. Middle aged women were affected particularly during ignition of evening lamps. Carbide lamp was another source of injury. Conclusion: Males are more commonly affected by calcium carbide related ocular injuries. Children and young adults are the common victims. Such injuries can involve both the eyes and cause a permanent visual disability.

Keywords: calcium carbide, ethylene, ocular burn, West Bengal, India

Introduction

Calcium carbide (CaC₂) is used in the fruit ripening industry as a source of acetylene which is analogous to the natural plant hormone ethylene (Patnaik, 2003; Abeles & Gahagan, 1968). It is used extensively in rural households in West Bengal, eastern India, particularly during mango ripening season. Acetylene is a highly inflammable gas and it is often mixed with phosphene, another inflammable gas derived from calcium phosphide which is found as an impurity with calcium carbide. Inadvertent ignition of these gases can cause severe ocular burn injuries particularly to the children while playing with calcium carbide with water in bottles thus making indigenous firework of shooting carbide or to the housewives while igniting evening lamps in rooms harboring un-lidded calcium carbide containers.

However, only one report of calcium carbide related ocular burn injury was found despite thorough MEDLINE search (Testud et al, 2002).
Here, we present 33 such patients who attended our tertiary care eye hospital in Kolkata, eastern India in last two years to emphasize the importance of calcium carbide as a source of ocular burn injuries during mango ripening season of West Bengal.

Materials and methods
This was a prospective case series. All the patients who attended the eye emergency and OPD of a tertiary care hospital in Kolkata, West Bengal, eastern India, suffering from burn injuries from calcium carbide ignition during mango ripening season of last two years (from April to July in 2010 and 2011) were included in the study.

Detailed ocular examinations were done for the patients. Assessment of visual acuity, slit lamp examination, fundus examination with 90 D lens and indirect ophthalmoscopy were done wherever possible. Ultrasonography B-scan and X-ray orbit were performed as and when indicated. The classification of injuries (Kuhn, 1996) was done using the Bermingham eye trauma terminology system (BETTS). A written informed consent was taken from all the patients/their parents and the permission from the institutional ethics committee was obtained. All the patients were followed up for at least three months.

Results
Fifty-five eyes of 33 patients were observed with ocular burn injuries due to calcium carbide during the study period from April to July in 2010 and 2011, during mango ripening season of West Bengal. Among them 20 patients (60.6%) were male. Injury was bilateral in 22 patients (66.66%). Right eye was involved in 28 cases and left eye was involved in 27 cases. Age range of the patients varied between 9 years to 50 years. Seventeen patients were below 20 years of age.

Children were mainly injured while playing with calcium carbide and water in lidded glass bottles, thus creating indigenous fireworks. After vigorously shaking the glass bottles, the mouth of the bottle was ignited which caused the blasts. Women while igniting evening lamps caught fire in the rooms harboring un-lidded calcium carbide containers. Carbide lamp was another source of injury.

The most common presentation was blisters over the eye lids and superficial corneal burn (13 patients, 39.4%) followed by sclero-corneal rupture with uveal tissue prolapse (10 patients, 30.3%). Corneal deep burn with limbal ischemia was found in 8 patients (24.24%). Four patients (12.12%) presented with hyphema and 6 patients (18.18%) had cut injuries over the lid. According to BETTS, 10 eyes had open globe injuries and 45 eyes had closed globe injuries (Table 1).

Table 1: Distribution of eye trauma according to BETTS*

<table>
<thead>
<tr>
<th>Type of injury</th>
<th>Number of eyes (Total no.55)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contusions</td>
<td>4</td>
</tr>
<tr>
<td>Lamellar lacerations</td>
<td>8</td>
</tr>
<tr>
<td>Superficial foreign bodies</td>
<td>33</td>
</tr>
<tr>
<td>Penetrating injury</td>
<td>6</td>
</tr>
<tr>
<td>Perforating injury</td>
<td>0</td>
</tr>
<tr>
<td>Ruptured globe</td>
<td>4</td>
</tr>
</tbody>
</table>

* Bermingham eye trauma terminology system

Table 2: Visual outcome of 55 eyes of 33 patients suffering from calcium carbide related ocular burn injury

<table>
<thead>
<tr>
<th>Vision</th>
<th>At initial presentation (Number of eyes)</th>
<th>After 3 months (Number of eyes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;20/40</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>20/40 – 20/200</td>
<td>35</td>
<td>43</td>
</tr>
<tr>
<td>&lt;20/200 - CF</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>HM+</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>PL+</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>PL -</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

CF – Counting finger, HM – Hand movement, PL – Perception of light

At initial presentation, one eye of a 9-year-old boy had no perception of light (PL negative), which ultimately had to be enucleated. The visual acuity of hand movement to perception of light (PL positive) was found in 12 eyes. Seven eyes had vision of counting fingers to 20/200. Visual acuity was 20/40 to 20/200 in 35 eyes. After 3 months follow up 43 eyes had improved visual acuity at the range of 20/40 to 20/200 (Table 2).
Vision did not improve in 3 patients with visual acuity of hand movement to perception of light. Another eye deteriorated from PL positive to PL negative state.

Thirteen patients with superficial eyelid burn and superficial corneal burn were treated at the ophthalmology outpatient department. Twenty patients with blisters and cut injury of the eyelids, deep corneal burn with limbal ischemia, sclero-corneal rupture with uveal tissue prolapse and hyphema were admitted. All the patients were given copious normal saline wash and all the particulate matter and soot particles were removed under local anesthesia with forceps. Sclero-corneal ruptures were repaired in all the cases except in one patient where the eye had to be enucleated (3% of all patients). The patients with hyphema were given anterior chamber wash and cut injuries over the lids were repaired. The patients were treated with systemic antibiotics, antibiotic-steroid eye drops and ointments, cycloplegic eye drops and tear substitutes. Regular dressings were done and the conjunctival fornices were swept with glass rods to prevent symblepharon.

Discussion
Ocular burn injuries due to fire crackers have been reported during various ceremonies all over the world. These injuries are common during Deepavali and Kalipuja, Gurupurva and Shab-e-Barat in India (Arya et al, 2001; Kumar et al, 2010). To the best of our knowledge, after a thorough MEDLINE search, there was only a single report of ocular burn injury due to calcium carbide published in the literature (Testud et al, 2002). In the Netherlands, there is a traditional custom called Carbidschieten (Shooting Carbide) where carbide and water are put in a milk churn with a lid and ignited with a torch to create an explosion (Carbidschieten 2009). In mango ripening season of West Bengal, eastern India, calcium carbide is widely available in village households as a cheap alternative to ethylene, a natural plant hormone. The indigenous copying of this Dutch fire works by the village boys of West Bengal was the main cause of calcium carbide related burn injuries to the children under 14 years of age. In other instances, women while igniting evening lamps caught fire in the rooms harboring un-lidded calcium carbide containers. Calcium carbide used in carbide lamps was another potential source of ocular burn injuries.

Males were predominantly affected (60.6%), which was similar to other ocular burn injury studies (Arya et al 2001, 83.3%). Most of the patients were below 20 years of age (17 patients, 51.51%) which corroborated with the findings of Arya (2001) et al (61.9%). We got a high percentage of female patients of 20 years to 40 years of age affected by the calcium carbide related ocular burn (12 patients, 36.36%). They suffered from the injury mostly while lighting evening lamps. Also, bilateral injury was higher (22 patients, 66.66%) in present study than in other studies (Arya et al 2001, 11.9%). However, the enucleation rate (3%) was similar to the other studies (Arya et al 2001, 2.3 %). Therefore, calcium carbide used as a mango ripening agent was found to be a potential source of ocular morbidity due to burn injuries in our study. Also, the high amount of carbide needed to ripen the immature fruit and the presence of trace amounts of arsenic and phosphide in carbide make the healthy food tasteless and toxic.

Conclusion
It is important to be aware of the potential blinding effects of calcium carbide explosion. The promotion of fruit ripening in centralized fruit processing units and the use of alternate safer agents like ethylene, a natural plant hormone can prevent such disastrous consequences and provide healthy fruits to the consumers.

References


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Brief Communication

Myopia in school children from high mountain region of Nepal

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Abstract

Objective: Myopia is emerging as a public health problem in school going children. Prevalence of myopia differs in different geographical areas, race, ethnic groups and socioeconomic background. Purpose of this study was to find out myopia prevalence in school children from very high mountain region of Nepal. Materials and methods: It was a cross sectional descriptive study. Vision screening was conducted in Snowland School among the children who come from high mountain region. Vision screening was done by volunteers using standard Snellen’s chart. Those who failed screening test underwent a detailed ophthalmological examination by a pediatric ophthalmologist. Results: A total of 140 children had their vision assessed. Mean age was 13.9yrs (±2.8yrs SD). On screening, 28.5% children (n=40) had vision less than 6/9 in at least one eye. Seven children were already wearing myopic glasses, among which only 2 had vision 6/9 or better. Out of 40 children, 10% (n=4) had vision 6/9 or better and 90% (n=36) had refractive error. Out of these 36 children, myopia was present in all (100%). Hence prevalence of Myopia in total school population was 27% (n=38). All the children had simple Myopia from 0.5D-3.5D. After refractive correction, all the children had best corrected visual acuity of 6/9 or better. 86% (n=120) children never had their eyes checked before. Conclusion: The study showed high prevalence of myopia and was only ocular morbidity present in children. The result of this study can be a baseline in conducting large population based study in children from high mountains of Nepal.

Keywords: Myopia, Nepal, high mountains, school children

Introduction

Myopia is one of the major causes of preventable visual loss worldwide. Increased prevalence of myopia in teenagers and young adults attending schools has been well documented (Lin LL, 1995; Chung KM, 1996; Pokharel A, 2010). However cause of myopia is still a subject of an intense debate. Etiology of myopia, whether genetic or environmental is still a controversial issue. Myopia no doubt is emerging as a public health problem worldwide. Prevalence of myopia varies greatly among the races and societies (Sew Mei Saw, 2003; Tay MT, 1992). Epidemiological studies have shown myopia prevalence higher in Asian population. In Nepal, many reported studies showed that prevalence of myopia among school children varies from 3 to 11% (Pokharel GP, 2000; Nepal BP et al., 2003; Pokharel A, 2010). The Snowland School is located in the outskirt of Kathmandu. It is a boarding school for the children from rural Himalayan villages, mainly from the regions of Solukhumbu, Mustang, Mugu, Dolpa, Humla, Humla of Nepal and some from Tibet. Many of these children are orphanages or from poor families who have limited access to education. The teachers in
the school noticed a large number of children having difficulties seeing a distant board or taking part in the activities that involved accurate distant vision. Hence, vision screening was carried out to find out the prevalence of ocular morbidity in these school children.

**Materials and methods**

The type of study: A cross-sectional descriptive study was carried out.

**The screening in school**

Vision screening was done by the volunteers who were elective medical students from United Kingdom in their final year of medical school. Monocular visual acuity examination was done by using standard Snellen E chart kept at the distance of 6 meters. The children who had vision less than 6/9 were retested to confirm the accuracy of screening and prevent unnecessary referral. Children wearing glasses were screened with their current glasses. All the children with vision less than 6/9 in at least one eye was referred to the pediatric ophthalmologist for further examination.

**Examination in pediatric out-patient department**

Children who failed vision screening were examined by a pediatric ophthalmologist in out-patient department of International Children’s Hospital. All the children underwent the following examinations.

Visual acuity examination by using standard Snellen chart kept at a distance of 6 meters. Cycloplegic retinoscopy and the subjective refraction. Tropicamide 1% was used as the cycloplegic agent as it had a short onset of action and short recovery time. Refraction was done by a manual retinoscope (Heine, Germany), anterior segment examination by using a slit lamp, and fundus examination by using a direct ophthalmoscope. Myopia was included when there was spherical equivalence of 0.5 D or more.

**Results**

A total of 140 children had their vision assessed by the volunteers. Age ranged from 4-18 years. The mean age was 13.9yrs (±2.8yrs SD). The male children were 61% while female were 39%.

**The result of vision screening**

Out of 140 children, only 40% (n=56) had presenting visual acuity of 6/6 in both the eyes and 31% (n=44) had vision 6/9. The remaining 29% (n=40) children failed the vision screening criteria and referred to Pediatric Ophthalmologist (Table 1).

There were seven children who were already wearing glasses, out of which, only 2 had vision 6/9 or better with the current myopic glasses. 86% (n=120) children never had their eyes checked before.

**The result of ophthalmologist’s examination**

A total of 40 children fulfilled the referral criteria. On examination, 10% (n=4) of them had a vision of 6/9 or better in both the eyes, i.e. false positive result, whereas 90% (n=36) had a vision worse than 6/9 in at least one eye. Of them, 100% of the children had a myopia. Among the children who were on glasses, 2 had a vision better than 6/9 with glasses and they had been diagnosed as myopes beforehand.

The severity of myopia has been shown in table II. All the children with myopia improved to vision 6/9 or better after refractive correction. The prevalence of myopia in this school population was 28% (n=36+2).

On analyzing the relationship of myopia with the age, there was no statistically significant relationship (p =0.543) Myopia was more common in the age group of 15 years (Figure 1).

**Table I: The presenting visual acuity in children**

<table>
<thead>
<tr>
<th>Presenting visual acuity</th>
<th>Number(%) of children</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/6</td>
<td>56(40%)</td>
</tr>
<tr>
<td>6/9</td>
<td>44(31%)</td>
</tr>
<tr>
<td>6/12</td>
<td>12(8.6%)</td>
</tr>
<tr>
<td>6/18</td>
<td>10(7.3%)</td>
</tr>
<tr>
<td>6/24</td>
<td>7(5%)</td>
</tr>
<tr>
<td>6/36</td>
<td>6(3%)</td>
</tr>
<tr>
<td>6/60</td>
<td>5(4.3%)</td>
</tr>
<tr>
<td>Total</td>
<td>140(100%)</td>
</tr>
</tbody>
</table>
Table II The severity of Myopia in children

<table>
<thead>
<tr>
<th>Myopia in Diopter</th>
<th>No(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5-1</td>
<td>13(34.2%)</td>
</tr>
<tr>
<td>&gt;1-2</td>
<td>11(28.9%)</td>
</tr>
<tr>
<td>&gt;2-3</td>
<td>9(23.6%)</td>
</tr>
<tr>
<td>&gt;3-4</td>
<td>5(13.1%)</td>
</tr>
<tr>
<td>total</td>
<td>38(100%)</td>
</tr>
</tbody>
</table>

Discussion
Our study has shown a very high prevalence of mild to moderate myopia in the school children. None of these children had any other ocular abnormalities like strabismus or amblyopia. In Nepal there was a similar study done in children from the high mountain region (Gamer FL, 1999). In this study, the Sherpa children residing in the Kathmandu valley and children who reside in the high mountain region were compared. The study showed prevalence of myopia 2.9% in the Sherpa children and 21% in the Tibetan children. In our study, the prevalence of myopia was 28% which is the highest prevalence among all the studies done in school children in Nepal. The prevalence of myopia is different in the different geographical area, race, ethnicity and the socioeconomic environment. The studies from Singapore and Korea show high prevalence of Myopia in the school children (Tay MT 1992; Lim HT, 2005) similar to our study. There is no study done to compare the prevalence of myopia in different races. In Nepal there are mainly two races, Aryans and Mongolians. The people from the high mountain region are mainly of Mongolian race similar to the Chinese origin. May be this is one factor that myopia is common in this race of people. The limitation of our study is the small sample size. The large population based study would be better to find out the prevalence of myopia and other ocular morbidity in the children from the Himalaya regions.

Conclusion
The study showed high prevalence of myopia in school children native of high mountain region of Nepal. This was the only ocular morbidity present in these children. The results of this study will help as a baseline to conduct large population based study in schoolchildren from the high mountains of Nepal.

Acknowledgement
I acknowledge the volunteer medical students from the United Kingdom who helped in vision screening of the children.

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Review article

Retinal functional imager (RFI): Non-invasive functional imaging of the retina

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Abstract

Retinal functional imager (RFI) is a unique non-invasive functional imaging system with novel capabilities for visualizing the retina. The objective of this review was to show the utility of non-invasive functional imaging in various disorders. Electronic literature search was carried out using the websites www.pubmed.gov and www.google.com. The search words were retinal functional imager and non-invasive retinal imaging used in combination. The articles published or translated into English were studied. The RFI directly measures hemodynamic parameters such as retinal blood-flow velocity, oximetric state, metabolic responses to photic activation and generates capillary perfusion maps (CPM) that provides retinal vasculature detail similar to fluorescein angiography. All of these parameters stand in a direct relationship to the function and therefore the health of the retina, and are known to be degraded in the course of retinal diseases. Detecting changes in retinal function aid early diagnosis and treatment as functional changes often precede structural changes in many retinal disorders.

Keywords: Retinal functional imager, non-invasive retinal imaging

Introduction

Newer retinal imaging technologies help us in understanding the pathogenesis of many retinal pathologies such as diabetic retinopathy, age related macular degeneration, glaucoma and uveitis. Early detection and monitoring of these retinal diseases can prevent the onset of progressive vision loss and blindness. Imaging techniques can also provide a better understanding of the pathogenesis, aiding in the development of new treatment options. Most of the available newer retinal imaging tools addresses structural rather than functional changes. Retinal Functional Imaging (RFI) offers a noninvasive diagnostic approach to retinal function assessment and provides easy, direct, qualitative, and quantitative imaging of parameters including: (1) Blood-flow velocity (2) Capillary perfusion maps and microvasculature enhancement (3) Blood Oximetry (4) Metabolic intrinsic state/function (Nelson DA et al 2005).

The objective of this review was to show the utility of non-invasive functional imaging in various disorders. Electronic literature search was carried out using the websites www.pubmed.gov and www.google.com. The search words were retinal functional imager and non-invasive retinal imaging used in combination. The articles published or translated into English were studied.

The RFI’s imaging approach is similar to the one first used in the brain. Functional optical imaging is based on slow changes in intrinsic properties of active brain tissue is optimized for the architecture of the neocortex. This facilitated in vivo visualization of active cortical regions with
the unprecedented spatial resolution of 50 micron or less. It reveals activity-dependent changes in light reflectance, recorded using a camera with high spatial and temporal resolution. Functional signals are usually small, originating from activity-dependent metabolic, hemodynamic, and fast and slow light-scattering.

Adapting brain functional imaging techniques to the retina provides imaging of functional parameters directly related to the vitality and viability of the retina unlike most current powerful technological methods that only evaluate structural changes in the retina.

The RFI is capable of directly determining blood-flow velocity in the secondary and tertiary vessels of the microvasculature by tracking erythrocytes. Further analysis of the erythrocyte movement in the retina generates microvascular maps, capillary perfusion maps (CPMs) that complement the functional blood flow velocity measurements. The RFI also measures the variation in the reflected light with respect to the wavelength, assessing relative concentration of hemoglobin chromophores in both vessels and capillary background for information about intravascular oxygen content (oximetry maps) related to tissue vitality (Denninghoff KR et al 2002, Harris A et al 2003).

Principles and recording protocols
RFI system combines digital fundus imaging and functional optical imaging, with flexible parameter changes and standard data storage. Certain enhancements have been incorporated in the fundus camera to facilitate functional imaging.

1) Rapid sequential imaging: A 60 Hz, 1024X1024 pixel digital imaging system uses a stroboscopic flash lamp system to take snapshots of the fundus (35 degree of the central retina) at rates high enough to reduce inter-frame retinal motion and follow erythrocytes moving at up to 20 mm/sec. This sensitivity range is generally most appropriate for secondary and tertiary vessels, providing high resolution, region-specific flow information about the microvasculature.

2) Rapid delivery of illumination of sufficient intensity to permit low-noise imaging: In each series eight consecutive flashes with an interflash interval of less than 20 ms is delivered to a patient, generating eight images under a second. Multiple series of eight frames are obtained from each in one session. The captured eight frame sequences can be presented as a movie.

3) Multi spectral imaging (Rapid changes in illumination wavelength): This is performed for oximetric measurement. A fast filter wheel integrated in the camera is capable of rapidly switching up to four illumination wavelengths twice within 55 sec. This allows multiple wavelength image acquisition with little or no global eye movement.

4) Stimulus generator: It uses visual patterned stimulus with a specified pattern, frequency and duration.

In a single session, multiple series, each with 8 frames are obtained (following pupil dilation) by methods familiar to operators of standard fundus cameras. High optical magnification (standard 20° or 35° settings on the fundus camera optics) is preferred for imaging modalities that rely on erythrocyte motion (including velocities and CPMs). Both narrow- and wide-angle settings are appropriate for oximetry. A subject may sit for 5–15 min per session, and image sequences and initial results can be quickly reviewed during the acquisition session, allowing reacquisition whenever needed. Three series with 8 high quality frames in each should be selected for blood flow measurements. The image should be of good quality with precise focus and exposure. Image quality is defined according to the percentage of vessels excluded. Any velocity results yielding a coefficient of variance (SD/mean) greater than 45% are indicative of poor image quality. The raw data obtained in a single sequence resembles familiar red-free images, except that they have been taken only milliseconds apart, and at different wavelengths (e.g. for oximetry). Automatic algorithms perform sub-pixel re-registration of the images within a sequence and then apply differential
analysis to reveal the differences among them (Brown, LG 1992). This analysis reveals image differences due to the phenomena described above.

**Retinal blood-flow**

Under green illumination, hemoglobin within the erythrocytes in the bloodstream provides a natural, high-contrast chromophore (at wavelength between 530-590 nm) for tracking blood flow (Jensen PS and Glucksberg MR 1998). Cross-correlation matching of moving erythrocyte patterns within an image series gives a direct measure of velocity. The RFI measures velocities in second and tertiary branches of the main retinal vessels (both arteries and veins). These secondary and tertiary vessels as extensions of the central artery are responsible for the delivery of 20–30% of the total ocular blood flow to the inner retinal layers. The RFI is unique in that it allows studying flow velocity changes in a large number of arterioles and venules simultaneously. The red blood cells appear dark under green light and are arranged randomly along the length of the blood column. This creates a light and dark pattern along the vessel which is preserved even as it moves forward. The RFI’s flow measurement technique looks for correlations between patterns imaged at different times in order to determine how far the pattern has advanced during the imaging interval.

The re-registration and differential processing of a series of images taken at 50-60 Hz produces a “flow movie”, in which it is possible to follow the motion of individual clusters of red blood cells or even single red blood cell (Figure 1). Flow velocity quantification is necessary for any objective study of the relationship of blood flow and disease. Manual, spot-by-spot measurement of distance moved per frame interval is the most direct method of quantifying flow velocity. Manual method is too cumbersome for regular use. Automated flow velocity quantification is achieved by using a path-constrained cross-correlation technique (Figure2A & 2B). Path templates (essentially tracings over the blood vessels chosen for analysis) are generated from combining user supervision with automatic detection. During quantification, flow is assumed to be constrained to follow the paths thus defined. Cross-correlation analysis is used to determine the relative offset of path segments in sequential images, which contain approximately the same pattern of moving blood cell. The size of this offset, suitably calibrated and multiplied by the frame rate, gives blood-flow velocity (Nelson DA et al 2005).

A negative value indicates blood flow away from the heart, whereas a positive value indicates blood flow toward the heart. Landa et al, have showed in their study on RFI in normal individuals, the range of arterial blood flow velocity was between 3.7 and 5.8 mm/sec and the range of venous blood flow velocity was 3.0 and 4.5 mm/sec(Gennady Landa et al 2009). Venous RBF, analyzed by the RFI, significantly correlated with the thickness of the central retina, measured by SLO-OCT. Venous blood velocity increased linearly with the increase in the central retinal thickness. The RFI may thus be a useful tool for evaluating changes in retinal thickening(Gennady Landa et al 2009).

Finally, to facilitate the measurement of true flow (volume), or to permit cross-subject categorization of vessel flow velocity according to size, approximate vessel diameters can be obtained from the red-free images that comprise the primary data. The instrument’s analysis software suite provides a simplified light absorption model that may be used to fit the vessel’s measured profile, yielding approximate, but useful width measurements.

The RFI imaging system can clearly reveal the motion of individual clusters of red blood cells, providing a powerful tool for measurement of retinal blood dynamics. Currently, the RFI provides a velocity map; however, conversion of the velocity units to flow units has not yet been implemented. To accomplish this goal, the precise vessel diameter must be established, a task already accomplished by Blum et al (Blum M et al 1999).
The RFI's direct visualization of retinal blood flow, without the injection of contrast agents, opens up many new diagnostic possibilities of abnormal retinal blood flow velocity, particularly in capillaries, arterioles and venules. RFI can be used to study different collateral vascular patterns in normal individuals as well as in various retinal diseases. Landa et al. in their study showed that four patterns of retinal collateral circulation (Looped pattern, Vertical pattern, H-shaped pattern and Cilioretinal-retinal collateral pattern) were noted in normal individuals and in patients with various retinal disorders (Landa G et al 2010). RFI is also useful in many systemic diseases like diabetic retinopathy, hypertension and other retinal vascular disorders.

**Visualization of invisible or obscure vessels**
The “flickering” of pixels in a flow movie provides a source of contrast that distinguishes pixels that image in-focus blood vessels from those that do not. Plotting pixel value as a function of the standard deviation of each pixel over time thus produces a high resolution vascular map, calculated based on motion contrast, rather than total reflectance contrast. This technique reveals vessels which are indistinct or invisible in even a very sharp red-free image (Figure 3).

In RFI maps, since the movement of red cell clusters is more distinct and less motion blurring occurs, the clarity of smallest vessels is equivalent to that of large vessels. The resulting map non-invasively documents fine details of vascular anatomy that may otherwise be obscured or invisible.

**Capillary Perfusion Map**
Following image registration, pixel value distribution parameters are analyzed to locate blood motion, tracing microvasculature based on motion contrast rather than on total reflectance contrast. The RFI’s noninvasive capillary perfusion map (CPM) shows vessels that are indistinct or invisible in even sharp red-free images. The recently improved algorithm for CPMs now generate images providing, as much if not more details of the retinal microvasculature than corresponding fluorescein angiography (FA) images (Figure 4).

The RFI can assist in cases where adverse reactions to fluorescein injection have been observed (Kwan AS et al 2006). The most significant improvements of CPM over FA are (1) they are noninvasive (2) more detailed (3) allow follow-up at any frequency and (4) show where red blood cells are moving at approximately normal speed. In the latter context, variations between normal capillaries and capillaries exhibiting reduced red blood cell velocity cannot be detected with FA. CPMs also provide better detail of microaneurysms in patients with DR (Fig 5), including non-leaking microaneurysms that are rarely seen with FA. At present, however, one cannot infer from CPM maps the regions of leakage that are readily detected with FA, and detection of leakage remains a future challenge for RFI noninvasive imaging.

Clinical Studies with the RFI show special characteristics in diabetic patients with NPDR (Fig 6). The RFI reveals a significant velocity decrease compared to healthy controls (Delori FC 1998). In patients with early DM with no diabetic retinopathy, the RFI can detect an increased blood flow velocity compared to controls and CPM imaging showed an increase in foveal avascular zone in diabetic patients compared to healthy controls (Burgansky-Eliash Z et al 2010). CPM imaging showed areas of capillary non-perfusion in patients with diabetic retinopathy and BRVO in correspondence with FA findings (Burgansky-Eliash Z et al 2010).

Following ischemic area and changes in blood flow velocities are helpful in early diagnosis of conditions developing in diabetic eye as well as tailoring the treatment (Figure 7, 8).

In AMD patients, RFI detected reduced blood-flow velocity in exudative AMD eyes compared with fellow dry AMD eyes. Average blood flow velocity in arteries and veins was significantly lower in AMD patients compared to controls. Drug effects on the retina have also been studied with the RFI (unpublished data).
Following intravitreal bevacizumab (Avastin) injections, a distinctive pattern of change in patient retinal blood-flow velocity was noted in responders versus non-responders. In retinal vascular occlusion patients neovascular loops are better imaged on RFI than on flourescein angiography (Figure 9).

In glaucoma patients RFI is useful in the evaluation of para papillary blood flow in microvasculature perfusing the optic disc as it relates to the vascular pathogenesis in different types of glaucoma (Figure10).

**Multispectral imaging for retinal oximetry**

The difference between the absorption spectra of oxy- and deoxyhemoglobin can be used to determine the oxygenation of blood with spectroscopic methods.[11]

Alterations in either oxygen supply or consumption might directly indicate the early onset of retinal abnormalities (Stefansson E et al 1983; Stefansson E et al 1992: Tiedeman JS et al 1998: Sebag J et al 1989). Thus, it is important to have a tool for qualitative and quantitative assessment of oxygen utilization in the retina. In multi wavelength mode, RFI can perform spectroscopic decomposition to quantitatively assess the oximetric state of the retina (Figure 11).

The qualitative map has limited value compared to quantitative oximetry, but does have role in clinical conditions. However the optical complexity of the retina hampers the quantitative evaluation of oximetric maps (Burns SA et al 2003). Perfusion deficits and abnormalities appear as a region of color distinct from their surroundings. Poor perfusion areas appears blue, highly perfused area appears red (Figure 11).

In patients with diabetic retinopathy, regions appearing normal in fluorescein angiogram are patchy darker in the oximetric maps- suggesting ischemia. This underscores the significance of qualitative oximetric imaging as a supplement to angiography that can detect anoxia directly, rather than by inference from dye leaks. As with RFI CPMs, oximetry maps are also capable of providing a high-resolution detail of microaneurysms in patients with diabetic retinopathy, as they are not obscured by the leakage that occurs in FA.

Multispectral filter wheel allows choroidal vessels visualization using near infrared light and pigment density maps. The benefits of using the multi-spectral imaging oximetric include rapid non invasive imaging of the retina, providing results indicating oximetric state regions of ischemia and direct visualization of choroidal vessels without using a contrast agent. Current studies are examining changes in oximetry state in patients with diabetic retinopathy as a result of laser treatment.

**Retina functional metabolic signal**


The RFI is capable of imaging outside the absorption range of photoreceptors under near-infrared light (750–840 nm) and can be used to optically monitor retinal activity in response to a well-defined visual stimulus (562±20 nm) The difference between the post-stimulated and pre-stimulated images is used to determine the metabolic state of the retinal compartments(Fig 15&16). Retinal functional imager shows the metabolic state of the directly activated retina thus helps in imaging the functional state of the axonal arches, which are the activated axons of ganglion cells leading from the activated area to the optic nerve head. Also useful in imaging blood flow, blood volume & oximetric changes under photic activation.

Among the limitations of the RFI, is the fact that it is not a real-time device. It must be synchronized with patients’ heartbeat using oximeter. Instrumental artifacts may arise from
imprecise focus and localization during image acquisition. Relatively clear ocular media is important for obtaining pictures with a good resolution, which often limits its use in patients with complicated ocular conditions. Depth of penetration is limited by the transparency of the retina, which varies with the illumination. Also the illumination wavelengths are restricted to the range of light at which hemoglobin absorbs well and which the eye returns in sufficient quantities to produce a good signal-to-noise level.

The RFI gives information on velocity only and not on flow volume because of resolution limitations. Future refinements of the technique and software enhancements should remedy some of these limitations. Acquisition of the highest quality images requires optimizing the focus of the captured image. This can be improved by an automated focusing system or enhancing depth of field by reducing the aperture size post-processing. These improvements would require faster, more sensitive components. Digital image focus enhancement is another possibility and also being pursued. The RFI’s facility for acquiring multiple images with near simultaneity makes applications of these types of techniques a real possibility. Improvements in digital camera technology will also help to enhance RFI image quality.

In conclusion, the Retinal Functional Imager is a new clinically applicable method for estimation of the retinal blood flow velocity, perfusion and microvascular structure. It shows promise of being able to detect subtle circulation changes both in normal subjects and those with ocular disorders. Detection of functional parameter abnormalities may permit diagnosis of diseases and to evaluate disease progression before anatomic abnormalities become evident, allowing treatment intervention before irreversible retinal damage occurs. It also opens research and drug development opportunities respecting a wide range of retinal diseases, beyond the capabilities of structural imaging. Future modifications in RFI will help a long way in avoiding many invasive diagnostic retinal tools.

Figure 1: Differential images - Black spots are erythrocyte or erythrocyte Cluster. White spots or gaps, represent absence of erythrocytes. The direct nature of measurement allows simple inspection of a flow movie to quickly reveal gross abnormalities in blood flow.

Figure 2A: Arteries (red) and veins (violet) that were manually selected for quantification.

Figure 2B: Blood velocity map - Measured velocities in veins (positive values) and in arteries (negative values) are presented in millimeters per second ± SD. (The average is based upon measurements from the three combined series)
Figure 3: Shunt and anastomotic vessels better seen in Diabetic retinopathy on RFI.

Figure 4: Capillary Perfusion Maps are obtained without any contrast agent such as fluorescein. Instead the red blood cells serve as an intrinsic contrast agent. Their flow shows the positions of the veins, arteries and capillaries. Retinal microvasculature including surface capillaries are seen better than most of FA images.

Figure 9: BRVO patient with superotemporal quadrant NVE better seen than on FA (colour FA and RFI).

Figure 10: Para papillary blood flow measurement in a Glaucoma patient.

Figure 11: Sickle cell retinopathy with highly perfused sea-fan neovascular loops. Areas of poor perfusion are seen as blue on qualitative oximetry.

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References


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Case Report

Ocular imaging findings of bilateral optic disc pit in a child

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Abstract

Background: To report a rare condition of bilateral optic disc pit in a child. Case description: A ten-year-old female was admitted with a complaint of headache. Visual acuity was 20/20 in both eyes (OU). Anterior segment examination was normal in OU. Fundus examination revealed optic disc pit (ODP) located temporally with a diameter of 1/5 disc diameter in OU. Intraocular pressure was within normal limits in both eyes. Macular optical coherence tomography (OCT) showed a loss of retinal tissue at the site corresponding to the ODP in both eyes. Retinal nerve fiber OCT revealed decreased RNFL thickness at the temporal side of the optic nerve, corresponding to the ODP in both eyes. The patient and patient’s parents were informed about the disease and called for follow-up examinations every 6 months. In addition, the family was informed about optic pit maculopathy (OPM) and, they were told to return immediately if the patient ever complained of decreased vision in either of her eyes. After a follow-up period of 12 months, visual acuity remained stable, and no complications secondary to ODP were detected. Conclusion: Optic disc pit is diagnosed incidentally unless it is complicated with OPM. The retinal nerve fiber layer thickness is decreased at the side of the optic nerve corresponding to the ODP.

Keywords: Macula lutea, optic disk, optical coherence tomography, retinal nerve fiber layer, retinal detachment.

Introduction

Optic disc pits (ODPs) were first described by Wieth in 1881 (Georgalas et al, 2011). They are ascribed to incomplete fetal closure of the optic nerve (Oltulu et al, 2011). They usually occur during the first trimester of embryogenesis (Oltulu et al, 2011; Goktas et al, 2010) and are thought to result from a disturbance in the development of the primitive epithelial papilla. In addition, a lack or loss of retinal nerve fibers has been observed at the site of the ODP (Oltulu et al, 2011; Goktas et al, 2010). An ODP is a round or oval-shaped, white, yellowish, grey crater-like depression in the optic disc. The prevalence of ODP is less than 1/11000 patients. Nearly 70% of ODPs are detected on the temporal side of the OD, 20% are located centrally, and the remaining 10% are situated inferiorly, superiorly and nasally (Oltulu et al, 2011; Goktas et al, 2010). The size of the pit varies from 0.1 to 0.7 disc diameter (Georgalas et al, 2011). ODPs may be associated with other abnormalities, such as optic disc coloboma and optic disc enlargement (Goktas et al, 2010; Georgalas et al, 2011). One or two cilioretinal arteries can be seen emerging from the pit base in up to 60% of patients (Oltulu et al, 2011). Unlike optic disc coloboma, an ODP does not affect the margin of the optic disc, and the
physiological optic cup remains distinct (Georgalas et al, 2011). ODP is unilateral in 90% of the patients, and only 10% of patients show bilaterality (Oltulu et al, 2011). In this case report, we present clinical, fundus imaging and optical coherence tomography (OCT) findings of a child patient who was diagnosed as bilateral uncomplicated ODP, which is a very rare condition.

Case description
A ten-year-old female was admitted to our outpatient clinic in July 2011 for routine examination. She was in excellent health and had no personal or family ocular or medical history of note. The visual acuity was 20/20 in both the eyes (OU). Cycloplegic retinoscopy findings of the right eye and left eye were both +1.00 diopters. Ocular motility and pupillary responses were normal in OU. Biomicroscopic anterior segment examination was normal in OU. The biomicroscopic fundus examination with a Volk 90 diopter lens revealed a vital optic disc associated with a gray, oval-shaped depression located temporally with a diameter of 1/5 disc diameter in OU (Figure 1-2). Foveal reflex and retinal vessels were normal. Intraocular pressure was 16 mmHg in the right eye and 17 mmHg in the left eye. Macular optical coherence tomography (OCT) showed loss of retinal tissue at the site corresponding to the ODP in both eyes, and no subretinal fluid was detected (Figure 3-4). Retinal nerve fiber layer (RNFL) OCT revealed decreased RNFL thickness at the temporal side of the optic nerve, corresponding to the ODP in both eyes (Figure 5). In light of these findings, the patient was diagnosed as bilateral ODP. Digital retinal photographs were obtained and the patient’s parents were informed about the condition and the patient was called for follow-up examinations every 6 months; however, she was told to return immediately if she ever complained of decreased vision in either of her eyes. After a follow-up period of 12 months, visual acuity remained stable, macular and RNFL OCT findings remained unchanged, and no sign of optic pit maculopathy (OPM) was detected.
Figure 5: Retinal nerve fiber layer optical coherence tomography of right and left eyes
Decreased retinal nerve fiber layer thickness at the site of optic disc pit in right (OD) and left eye (OS) marked with red circles and difference between nasal retinal nerve fiber layer and temporal nerve fiber layer thickness marked with blue line and arrow.

Discussion
Optic disc pit is usually asymptomatic in its uncomplicated form, as in this case. Visual acuity is normal in almost all patients, so ODP is detected incidentally in most cases; however, 25 to 75% of patients carry the risk of OPM (Oltulu et al, 2011; Goktas et al, 2010). Until 1988, it was thought that all OPM cases represented serous macular detachment. However, in 1988, Lincoff et al. proposed that, fluid from the pit initially causes an elevation of the nerve fiber layer which leads to a schisis-like inner layer separation, followed by the development of an outer layer macular hole and outer layer retinal detachment (Lincoff et al, 1988).

The origin of the subretinal fluid seen in OPM remains controversial. Four different sources have been assumed; vitreous fluid, cerebrospinal fluid, fluid from the leaky blood vessels at the base of the pit and fluid originating from the orbital space surrounding the dura (Lincoff et al, 1988). The onset of OPM is variable. Although ODP is congenital, OPM manifests later in life; the mean diagnosis age for OPM is reported as 30 years (Hirakata et al, 2005). Therefore, in the complicated patients it is assumed that ODP is not a stagnant disease and it progresses in time. A small hole overlying the pit, and the disappearance of the membrane overlying the pit were reported as the potential causes of OPM (Georgalas et al, 2011; Lincoff et al, 1988). Visual acuity loss, blurring, metamorphopsia and hyperopic shift in refraction accompany OPM (Goktas et al, 2010).

No treatment modality has been universally accepted for OPM, since none have been shown to be clearly more effective than the others. The rarity and the challenging nature of the condition have caused this dilemma. Conservative management was used for the initial management, as 25% of the cases resolved spontaneously; however, the visual outcomes were poor in these patients (Georgalas et al, 2011). Several treatment options like bed rest with bilateral patching and oral corticosteroids, laser photocoagulation and/or intravitreal gas injection, macular buckling surgery, pars plana vitrectomy with or without gas injection and internal limiting membrane (ILM) peeling were described (Georgalas et al, 2011). The first regimen was found to be ineffective, but pars plana vitrectomy techniques were found to be very promising (Georgalas et al, 2011). Diab et al., reported successful results from pars plana vitrectomy without ILM peeling in a case of optic pit maculopathy (Diab et al, 2010). Georgalas et al., reported favorable results in patients with optic pit maculopathy who were treated with pars plana vitrectomy and ILM peeling without laser photocoagulation (Georgalas et al, 2011; Georgolas et al, 2009).

Optic disc pit is a congenital defect of the optic nerve head; however, it is usually asymptomatic and is diagnosed incidentally unless it is complicated by OPM. Therefore, ODP may be rarely detected in children. Bilateral ODP is also infrequent. Our case was neither complicated with OPM nor needed a specific treatment. Bilateral ODP is a rare condition, and the macular and RNFL OCT findings of an asymptomatic ODP were clearly documented in this case report.
Conclusion
The optic disc pit can be found in both eyes and it is detected on routine examination in its uncomplicated form. The patients should be carefully informed about the visual symptoms and followed-up closely.

References


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Case Report

A rare case of a solitary intraocular neurofibroma

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Abstract

Background: Solitary neurofibroma in the absence of neurofibromatosis is of rare occurrence and very few cases have been reported till date. Objective: To report a case of a solitary intraocular neurofibroma Case: A 65-year-old man presented to us with a large swelling appearing to arise from right ptical eye for the past one and a half years. After knowing the extent and origin of mass lesion, right eyeball was enucleated and subjected to histopathological examination which revealed intraocular neurofibroma in the absence of neurofibromatosis which is of very rare occurrence. Conclusion: The isolated neurofibroma of intraocular origin can present as an isolated orbital mass without systemic features.

Keyword: Neurofibromatosis, solitary neurofibroma

Introduction

A neurofibroma is a benign tumor arising from Schwann cells of the peripheral nervous system. It is usually associated with neurofibromatosis type I, a multisystem autosomal dominant disorder in which the nerve tissue grows benign tumors that may cause disfiguration and serious damage by compressing nerves and other tissues. The disorder affects all neural crest cells, i.e., Schwann cells, melanocytes and endoneural fibroblasts. Affected cells exhibit biallelic inactivation of the NF1 gene at 17q chromosome that codes for the protein neurofibromin (Muir et al 2003). Apart from occurring in association with neurofibromatosis, isolated neurofibromas may occur. However, the exact incidence of true solitary or isolated neurofibroma occurring intraocularly or in the orbit is difficult to obtain because of its relation to neurofibromatosis in most of the cases. Because of its rarity, it is often difficult for an ophthalmologist to diagnose it on a presumptive basis.

Case report

A 65-year-old gentleman presented with a large, pedunculated swelling arising from the right ptical eyeball which had developed during the past one and a half years. The patient correlated its occurrence with a minor trauma to the right ptical eyeball one and a half years back, following which he noticed a small nodule which was painless and gradually progressed to the present extent of approximately 4 x 3 cm mass (Figure 1).

Figure 1: Showing the large swelling in the right eye.

The mass was hard in consistency with keratinization of the overlying surface. It appeared to arise from the superomedial aspect of the ptical
eyeball, effacing whole of the remaining structure.

A slit-lamp biomicroscopy examination of the left eye revealed a normal anterior segment except for grade I nuclear sclerosis. The fundus examination was normal.

The systemic examination presented with no significant findings. Systemic features of neurofibromatosis like multiple, multifocal neurofibromas, café au lait spots or axillary freckling were absent. The family history was not significant.

The USG of the right orbit revealed a hypoechoic mass lesion arising from the right phthisical eyeball and extending anteriorly into the right lower lid. It showed flow on Color Doppler and foci of calcification were also present. The CT scan revealed a heterogenous, fairly enhanced soft tissue mass occupying the whole of the right eyeball with foci of calcification in it. Stranding of retrobulbar fat in the region of the optic nerve head was present. No involvement of the opposite eye and brain was noted (Figure 2).

Informed consent was taken, and after knowing the extent and origin of the mass lesion, the right eyeball was enucleated and sent for gross and histopathological examination.

On histopathological examination, a proliferation of the nerve cells and Schwann cells forming lobules was seen, along with the foci of calcification. The result was an effacing of the structures of the eyeball. Several myelinated axons, bundles of Schwann cells and collagen fibres were distributed within a myxoid stroma which was positive for Alcian blue. Scattered perivascular lymphocytes were also seen. All these features confirmed the presence of an intraocular neurofibroma (Figure 3).

**Discussion**

Neurofibromas are benign tumors of the nerves characterized by proliferation of nerve cells and Schwann cells along with intervening fibrous components. These are most commonly associated with neurofibromatosis I along with other systemic findings. Those associated with NF I usually present in early childhood. Neurofibromas are radio-resistant and widely-infiltrating ones are difficult to excise surgically.

The exact incidence of isolated neurofibroma especially of those of intraocular origin is difficult to obtain; however, its occurrence is relatively rare. No case of isolated intraocular neurofibroma has
yet been reported as per our knowledge. Very few cases of isolated orbital neurofibroma have been reported. A study revealed a 93 % incidence of benign neurilemmoma or neurofibroma among orbital peripheral nerve sheath tumors (Rose et al 1991). They defined a family history of systemic neurofibromatosis in one quarter of the patients with a solitary neurofibroma. In a series of orbital tumor cases only three cases of a solitary neurofibroma, occurring in middle aged persons as a slow growing upper quadrant mass, have been reported (Rootman J 2003). Alkatan HM (2007) reported a case of an isolated neurofibroma of orbit in a 25-year-old male. Shields et al (1990) reported a case in which the patient had no manifestations of neurofibromatosis with three separate right orbital lesions.

In our case, it was difficult to determine the nerve and the underlying tissue from which the neurofibroma arose and whether the ptosis of the same eye preceded the development of the neurofibroma and was independent of it or not.

**Conclusion**

The isolated neurofibroma of intraocular origin can present as an isolated orbital mass without systemic features.

**References**


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Case Report

Conjunctival Kaposi’s sarcoma as the initial manifestation of acquired immunodeficiency syndrome

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Abstract

Introduction: Kaposi’s sarcoma is a common neoplasm in patients with acquired immunodeficiency syndrome (AIDS). Its presentation as an initial manifestation of AIDS is very rare. Objective: To report a rare case with Kaposi’s sarcoma as an initial manifestation of AIDS. Case: We report the case of a 37-year-old man who was a parenteral drug addict, HIV seropositive and was not under any treatment with a conjunctival lesion which was diagnosed as Kaposi’s sarcoma after surgical resection. Conjunctival Kaposi’s sarcoma is present frequently in HIV patients and lesions may be mistaken with other conjunctival lesions.

Keywords: Kaposi’s sarcoma, conjunctival neoplasm, AIDS

Introduction

Kaposi’s sarcoma (KS) is a common neoplasm in patients with acquired immunodeficiency syndrome (AIDS) (Shuler et al, 1989). It’s presentation as an initial manifestation of AIDS is very rare.

To date, there have been reported four cases of conjunctival KS as the first manifestation of AIDS (Hummer et al, 1993; Kurumety et al, 1995; Schmid et al; 2003; Curtis et al 2005).

A 37-year-old man presented with a conjunctival mass of one month duration. He was a parenteral drug-addict and was HIV seropositive and was not under any treatment for his illness. On examination, the best-corrected visual acuity was 20/20 in the right eye and 20/200 in the left (amblyopic). The slit lamp examination revealed a nodular, painful, red mass with a small depression at the center in the bulbar conjunctiva (Fig 1). The cornea, anterior chamber, iris, lens and retina were normal in both the eyes.

Figure 1: Red, nodular conjunctival mass

The first differential diagnoses included capillary haemangioma, pyogenic granuloma and Kaposi’s sarcoma.

His CD4 count at the time of presentation was 135 µl and the viral load was 8700. He had no other AIDS-related findings of any illnesses.

Surgical resection of the ocular lesion was carried out with care because of a possible HIV infection. We included a Tenon capsule with a 2 mm safe margin.

Histopathology showed the morphology of KS with proliferating spindle cells and numerous vascular...
slits, surrounded by a single layer of endothelium (Figure 2).

Figure 2: Proliferating spindle cells and numerous vascular slits surrounded by a single layer of endothelium.

At follow-up 26 months later, there was no evidence of tumour recurrence.

Discussion
Ocular involvement in developed AIDS is seen in 20% of patients and 7% can have conjunctival lesions (Shuler et al, 1989). KS related with AIDS in ophthalmic practice is found rarely as the first clinical manifestation.

In other studies, ocular involvement is seen in 70% of AIDS patients. It mainly presents as cotton-wool spots, cytomegalovirus chorio-retinitis and KS in the eyelids and conjunctivae (Kurumety et al, 1995). The conjunctival lesions are more frequently found in the inferior fornix (Shuler et al, 1989).

Lesions can be clinically confused with pyogenic granuloma, subconjunctival haemorrhage, cavernous haemangioma, conjunctival cysts, inflamed pinguecula or bacillary angiomatosis from Bartonella henselae infection.

Current studies suggest that Kaposi’s sarcoma is not a true tumour but a dys-regulation of an inflammatory response. It is associated with infection by human herpes virus 8, and the lesion’s growth depends on numerous cytokines and growth factors, including the tat gene from the HIV genome (Antman et al, 2000; Minoda et al, 2006).

There are several treatment modalities available for patients with Kaposi’s sarcoma, including chemotherapy, immunotherapy, radiation therapy, cryotherapy and excision (Brun et al, 1997).

Heimann et al reported a case of regression after treatment with 5 mg/day bleomycin injections intramuscularly on three consecutive days every two weeks (Heimann et al; 1997).

Hummer published a case of regression with subconjunctival injection of 0.5 ml of 3 million IU of interferon α-2a (Hummer et al, 1993). However, Shuler (1989) considers that treatment may be unnecessary and observation would be appropriate because of the slow growing of Kaposi’s sarcoma.

Conclusion
Conjunctival Kaposi’s sarcoma can be the first clinical manifestation in HIV patients and lesions may be mistaken with other conjunctival lesions. We suggest that the ophthalmologists consider KS among the differential diagnoses of ocular neoplasms in HIV patients.

References


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Case Report

Impacted iron nail in the orbit and maxillary sinus through a corneo-scleral perforation: a case report

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Abstract

Introduction: Open globe injury is one of the commonest ophthalmic emergencies, and when accompanied by intraocular foreign bodies, the condition carries a poorer prognosis. Objective: To report a rare case of perforating injury of the globe with an iron nail which got lodged in the maxillary sinus. Case: A ten-year-old boy presented with the history of sudden painful loss of vision in his right eye. He reported that he was hit forcefully by the tail of a cow a day before the presentation. There was no perception of light in that eye. The ocular examination revealed a full thickness corneo-scleral perforation with prolapsed uveal tissue. The X-ray of the right orbit showed an impacted foreign body in the inferior orbit and computed tomography scan of the orbit confirmed the presence of a vertically impacted metal piece in the right orbit and right maxillary sinus. The repair of the perforation and removal of the impacted nail was done in two stages. The globe anatomy was maintained but the vision could not be restored due to the grave nature of the trauma. Conclusion: Perforating globe injury is an important cause of monocular blindness.

Keywords: foreign body, perforation, trauma

Introduction

Eye injuries are an important cause of ocular morbidity in children, being a leading cause of non-congenital unilateral blindness in this age group (MacEwen et al, 1999). It is the most important cause of unilateral loss of vision in developing countries and 5% of all bilateral blindness is directly due to trauma (Thylefors et al, 1992). An estimated 7.9% of all blindness in Nepal is caused by ocular trauma (Brilliant et al, 1985). But it is believed that over 90% of all eye injuries can be prevented, making ocular trauma one of the important preventable causes of blindness (Parver et al, 1993; Whitcher et al, 2001).

Ocular injury can occur in three forms: open globe, closed globe and chemical injuries. Open globe injury is one of the commonest ophthalmic emergencies requiring urgent surgical attention. When the injury is accompanied by intraocular foreign bodies, the condition carries a poorer prognosis. The foreign bodies that enter the eye may cause damage in two different ways. They may produce structural damage to the intraocular contents as they enter the eye or may cause toxicity to tissues as they degrade and oxidize, if not removed early.

The public health importance of such ocular trauma is undeniable. Injuries generate a significant and often unnecessary toll in terms of medical care,
human suffering, long term disability, productivity loss, rehabilitation services and socioeconomic cost.

Case report
A ten-year-old boy presented in the emergency of B P Koirala Lions Center for Ophthalmic Studies, Kathmandu with the history of sudden painful loss of vision in right eye since one day. He gave a history of forceful hit by a cow’s tail on his right eye while working at the cowshed one day back. Following the trauma, he was unable to open his eye and there was severe pain and bleeding.

On examination, he was well oriented to time, place and person and his higher mental functions were intact. Unfortunately, there was no perception of light in his right eye while the visual acuity in the left was 20/20. The extraocular motility was full in all gazes. His right eyelids were mildly swollen but the orbital rim was intact with no crepitation and the overlying skin of the eyelids and of the face was also normal.

There was a diffuse ciliary congestion of the conjunctiva. A full thickness corneal laceration of 5.2 mm length extending from 3 mm beneath the superior limbus encroaching upto the inferior limbus at 6 0’clock position was present in the pupillary axis. The corneal perforation was continuous with the scleral perforation of 3.0 mm length. A shallow anterior chamber, presence of hyphema and prolapse of the iris tissue through the corneo-scleral laceration were also noted. The details of the lens and of the posterior segment could not be visualised. The left eye was normal.

The ultrasonography of the right eye was not attempted as the child was in pain and there were chances of extension of perforation on forceful attempt. An X-ray of the right orbit showed an impacted foreign body in the inferior orbit (Figure 1). The computed tomography scan of the orbit and the para nasal sinuses revealed a perforated right globe with a hyperdense vertical shadow occupying the right orbit and the right maxillary sinus suggestive of an impacted metal piece with no muscle entrapment (Figure 2a and 2b).

The patient was admitted after explaining the poor prognosis of the right eye and intravenous antibiotics were started. The primary repair of the corneo-scleral perforation with abscission of the prolapsed and necrosed iris was done on the emergency basis. The hyphaema was washed out and the cataractous lens was visualised. However no intraocular foreign body was found during the surgery. In the second sitting after three days of primary repair, a combined operation was done with a maxillofacial surgeon. An exploration of the orbital floor and maxillary sinus was done via a subciliary incision. An iron nail of 2.5 cm length was found with the head embedded in the orbital floor 2 cm posterior to the inferior orbital rim. The tip had penetrated the orbital floor and the roof of the maxillary sinus and was entrapped therein vertically. The nail was removed in a single piece (Figure 3).

Post operatively, the intravenous antibiotics were continued together with oral analgesics, topical antibiotics and steroids with cycloplegics. The vision was no perception of light, the wound was healthy with intact sutures, the anterior chamber was formed with residual hyphaema and the lens was cataractous with no view of the retina (Figure 4). Ultrasonography revealed posterior perforation of retina and sclera.

During his hospital stay, he was administered intravenous and topical antibiotics and steroids (in low dose). The patient was discharged on the 13th day of admission with oral antibiotics and low dose oral steroids in a tapering dose and topical antibiotics. On follow-up after three weeks, the visual status was similar, the eyeball was soft, the corneal sutures were intact. The anterior chamber was formed with a non-reactive pupil and a cataractous lens. The intraocular pressure was only 6 mmHg suggesting the ongoing state of atrophic bulbi.
Discussion

This is a rare case where an iron nail entered into the globe via a corneo-scleral perforation, pierced the lens and exited through the retina and posterior sclera from where it perforated the floor of the orbit and finally got lodged in the maxillary sinus. Worldwide, ocular trauma is an important cause of eye morbidity. Open globe injuries (53.9%) are more common than closed globe injuries (42.2%) and boys are affected more frequently than girls are (Saxena et al, 2002). In a study from western Nepal, 57% of the children were male, most of them were of the age group 5-16 years. The perforating eye injury was found in 5% and ultimately 5% had no perception of light even after treatment (Adhikari et al 2010).

The nature of trauma suggests that the child must have received a forceful high velocity trauma with the cow’s tail with the nail entangled in it. The floor is the weakest part of the orbit - this might be the other reason for the ease with which the nail traversed it. The prognosis in such a case is very poor but timely removal of the foreign body is essential to prevent the siderosis-related complications.

The most important aspect of pediatric eye trauma is prevention. The irreversible nature of visual loss and the immense morbidity associated with it need to be emphasized and publicized. Visually impaired children as a result of trauma have a significant
negative impact on the trauma victims themselves, the community they live in, and to the nation as a whole in terms of sufferings, medical cost and loss of productivity.

**Conclusion**

Open globe injury carries a poor prognosis for vision and when superadded with a retained foreign body leads a child to suffer from long term visual impairment. This has a major impact on social, emotional and psychological development of a child.

**References**


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Traumatic avulsion and bilateral eye loss: report of two cases

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Abstract

Background: The optic nerve and the globes are resistant to mild to moderate trauma and bilateral avulsion of the eyes is rare with only a few cases reported in the literature. Case: We report two cases of traumatic bilateral eye avulsion. The first case was secondary to a bear bite and was managed successfully, although the eyes were not salvageable whereas the second case which was due to physical assault expired due to associated severe head injury. Conclusion: Traumatic bilateral globe avulsion/loss is a rare complication of trauma. In developing countries like Nepal, poverty, forest encroachment activities, extensive deforestation, frequent domestic disturbances and lack of education are some of the circumstances that increase the probability of such visual injuries.

Keywords: bear bite, bilateral globe avulsion, face, fracture, injury

Introduction

Avulsion or subluxation of the eyes is associated with trauma of the face or the orbits (Tunçbilek et al, 2008). Bilateral avulsion is though rare with only a few cases reported in the literature (Razmju et al 2009). The Himalayan black bear (Ursus thibetanus or Selenarctos thibetanus) is a threatened animal in the Himalayan range and has occasional contact with humans causing bite injuries (Hayashi et al, 2003; Rasool et al, 2010). We report two cases of traumatic avulsion and bilateral eye loss.

Case report

Case one

A 35-year old female who had been attacked by a bear while cutting trees in the forest presented to the hospital in shock after six hours of sustaining the injury. The dressing of the injury was extensively soaked with blood and her Glasgow coma score (GCS was) 11/15. Clinically, the left eye was missing, the right eyeball avulsed and avulsion of a part of the scalp and the nose (Figure-1). Computed tomogram (CT) showed a fracture of the right frontal bone extending to the skull base and herniated brain matter. She underwent emergency surgery with contusectomy, dural repair and closure of the frontal wound with enucleation of the damaged eye, repair of the ear laceration and re-approximation of the avulsed scalp. She was given seven units of blood transfusion and was ambulated on the fourth day. The sutures and staples were removed in the second week after which she was discharged. Psychiatric counseling regarding her loss of sight was done and at the twelve-month follow-up she was doing fine, except for the visual loss, with no other neurological deficits.

Case two

A 30-year-old male was brought to the emergency with a history of physical assault over a domestic issue and loss of consciousness since the assault. On examination he was in shock, with a GCS of 7/15, and with active bleeding from the scalp vessels.
The left globe was prolapsed with partial loss of its contents while the right globe was crushed by the fractured orbit (Figure 2). There was a large scalp-skull defect with herniating brain matter over the right frontal area. The CT showed extensive fractures of the anterior skull base and of both the orbits. Primary ABC management along with blood transfusion was done and the patient was kept on a ventilator. The patient party did not consent to neurosurgical/ophthalmological intervention in this case, and despite all efforts, he succumbed to the severe head injury and expired on the fourth day.

**Figure 1:** Picture showing loss of the left eye, complete scalp avulsion and avulsed right eye

**Figure 2:** Showing severe comminuted fracture skull with herniating brain matter, loss of left eye and avulsed right eye

**Discussion**

Optic globe avulsion is a rare injury usually associated with trauma to the maxillofacial structures (Tunçbilek et al, 2008). Management of such injuries should include the ABC of trauma care with a later multidisciplinary team approach for the best functional and cosmetic result. Adequate investigation with the help of a skiagram or CT with debridement and primary closure is the best option. Aerobic and anaerobic coverage should be included. The most important issue in such problems is the repositioning of the globe with possible revival of vision. Many studies have shown that urgent and early repositioning of the eyes has led to salvaging the globe although the visual prognosis still remains poor (Razmjua et al, 2009). It is also recommended that even though the probability of visual recovery is not high, the globe should still be replaced to improve the psychological outcome in such patients (Bajaj et al, 2000). The nonfunctioning eye may then be enucleated at a later date.

The rural population of some of the hilly and mountainous regions of Nepal face the risk of attacks by wild animals in the nearby forests. Lawlessness and alcoholism also contribute to social problems and physical assaults. There is thus a role for the government for stricter forest management and prevention of deforestation and illegal encroachment of land. The problem of rampant alcohol abuse must also be addressed. These measures, together with the improvement of the education among the common masses, will help reduce the incidence of such eye injuries as presented in our two cases.

**Conclusion**

Traumatic bilateral globe avulsion/loss is a rare complication of trauma. In developing countries, poverty, encroachment activities during extensive deforestation, frequent domestic disturbances and lack of education increase the probability of such visual injuries.

**References**


Roka N et al
Traumatic avulsion and bilateral eye loss: report of two cases


Source of support: nil. Conflict of interest: none
Recurrence of uveal malignant melanoma: a case report
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Abstract

Background: Malignant melanoma of uveal tract is a rare ocular malignancy. It is one of the significant causes of ocular morbidity and mortality which is less commonly seen in children.

Case: We report an unusual case of orbital recurrence of malignant melanoma in a 14-year-old boy who had previously undergone enucleation of the left painful blind eye 8 months ago. He was diagnosed to have uveal malignant melanoma elsewhere which was confirmed by histopathology. Orbital recurrence was managed with modified exenteration with adjuvant chemotherapy and radiotherapy. Conclusion: In all treated cases of uveal melanoma, close follow up examination and monitoring is necessary for early diagnosis of the recurrence and to plan for further management.

Keywords: enucleation, uveal melanoma, recurrence

Case Report

A 14-year-old boy presented with fleshy growth in left orbit after removal of that eye about 8 months back. He gave the history of high velocity trauma with the cricket ball to the left eye in early childhood. According to the patient, his both eyes were normal before the trauma. Following the injury, he was diagnosed as a case of retinal detachment in left eye in peripheral eye hospital of eastern Nepal. He was advised to go to tertiary eye centre immediately for possible surgery. But the patient did not seek any further treatment. Subsequently, he gradually developed pain in that eye associated with constant headache which was localized to the parietal region, not associated with nausea, vomiting or fever. He used to use some topical medicine and oral analgesics for the pain but still did not take any medical help. He visited the eye hospital only after 2 years when the pain became intolerable. In the ophthalmic record from the peripheral eye hospital, his visual acuity in the right eye was 6/6 and in the left, there was no light perception. The anterior chamber was shallow with cataractous lens in the
left eye. The IOP was raised to 50 mm of Hg. The ophthalmic findings in the right eye were normal. The CT scan of the orbit and head was also done, which showed left orbital mass, with calcification in posterior vitreous cavity. The brain scan was within normal limits (Figure 1). The diagnosis of left painful blind eye with secondary glaucoma was made and left eye enucleation surgery was performed 8 months ago in the same hospital. Histopathological examination of the enucleated eye showed malignant melanoma with resected optic nerve end free of tumour cells. He was referred to oncologist but the patient did not go for further management.

On the first visit of the patient to our institution, his visual acuity in right eye was 6/6 whereas the left side had anophthalmic socket S/P enucleation. There was a fleshy growth occupying the left socket with fornicial fullness (Figure 2). The conjunctiva overlying the mass was pink and transparent with moderate discharge. The regional lymph nodes were within normal limit. Systemic examination was done by Paediatrician which was normal. CT scan of orbit and brain was also done which showed a contrast enhanced heterogenous lobulated mass in the left socket with prominent calcification. The left bony orbit was widened with area of erosion in the medial wall. The findings were suggestive of recurrence of malignant melanoma of the left orbit (Figure 3).

Incisional biopsy of the lesion showed malignant melanoma of spindle B type. Bone marrow aspiration showed normocellular marrow with no evidence of malignant cells. With the available clinical evidence along with biopsy report, the diagnosis of recurrent malignant melanoma of left orbit, without systemic metastasis was made. In our centre, lid skin sparing modified exenteration of left orbit was performed and chemotherapy was started (Figure 4). Inj Dacarbazine 275 mg in 200 ml NS over 1-2 hours OD for 5 days was given, as advised by Paediatric oncologist. The histopathology of orbital mass obtained from exenteration had shown malignant melanoma of spindle A type, infiltrating lacrimal glands and eye lid muscles. All margins of the exenterated mass was infiltrated with tumour cells. Hence, after completion of chemotherapy, the patient was referred to a cancer hospital for radiotherapy.
Discussion

Among all the primary intraocular tumours, uveal melanoma is the commonest one in adults. The most common intraocular tumour in paediatric population is retinoblastoma (Lee et al, 2000).

Here, we describe a case of malignant melanoma which is a rare presentation in paediatric age group. There is history of injury in the same eye before he developed ocular problem. Literatures have mentioned that many cases of uveal neoplasm are preceded by injury. Ocular trauma can be responsible for exciting obvious activity in a tumour which might have shown a latent course. Chronic intraocular inflammation may be a determining factor in some cases as seen in this case, where it took couple of years to develop clinical presentation (Nicoletti et al, 2006). In some of the cases of intraocular tumour, phthisis bulbi may be a frequent presentation where toxic effect of necrotic changes are observed.

Presentation with secondary glaucoma, as seen in this case, could be one of the presentations of intraocular tumour. When the tumour arises from ciliary body or if the tumour is large in size, it can directly compromise the angle structure increasing the resistance to aqueous out flow. Moreover, the malignant cells and macrophages with engulfed malignant cells can also clog the trabecular meshwork, giving rise to increased intraocular pressure (el Baba et al, 1988).

Regarding the treatment modalities, for the medium sized tumour, enucleation and brachytherapy has shown to have the similar results as far as survival rate is concerned (COMS group, 2006). Charged Particle Radio therapy is also an alternative treatment modality in medium sized uveal melanomas (Egger et al 2002). Stereotactic photon beam irradiation therapy (Muller K et al, 2005) and thermotherapy (Sheild CL et al, 1998) has shown significant role in treatment of choroidal melanoma. Photodynamic therapy has also been tried where there was failure of brachytherapy and trans pupillary thermotherapy (Barbazetto et al, 2003). Recurrence of uveal malignant melanoma is a rare complication which can be treated with exenteration along with chemo and radio therapy (Shields et al, 1984).

Conclusion

Malignant melanoma can be an unusual presentation in children. Recurrence of uveal malignant melanoma is a rare complication. In all cases of treated uveal melanoma, periodic ophthalmic examination is needed to diagnose the early recurrence and to plan for further management.

References


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Case report

Ocular myocysticercosis: an unusual case of ptosis
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Abstract

Background: Cysticercosis is common in endemic countries like India. It can have various clinical manifestations depending on the tissue involved. It refers to a parasitic infestation by Cysticercus cellulosae, the larval form of the pork tapeworm or Taenia solium. Objective: To report an unusual case of ocular cysticercosis involving the levator palpebrae superioris and superior rectus muscle of the right eye. Case description: A young, male adult was diagnosed by Magnetic Resonance Imaging (MRI) scan of the skull and orbit to have right-sided ocular cysticercosis. The patient was treated with oral prednisolone and albendazole, to which he showed a significant improvement. Conclusion: Ocular myocysticercosis can be diagnosed by MRI and be treated medically with steroid and albendazole.

Keywords: Cysticercosis, levator palpebrae superioris, superior rectus
In investigations, the complete blood count was normal. The MRI of the skull and of the right orbit showed bulky and edematous levator palpebrae superioris (LPS) and superior rectus (SR) muscles along with a small and rounded peripheral ring enhancing the cystic lesion. The findings were suggestive of inflammatory granuloma, and of myocysticercosis involving the LPS and SR in the right orbit. The enzyme linked immunosorbent assay for serum antibodies against cysticercosis was positive.

Diagnosis and treatment
The patient was diagnosed as a case of ocular myocysticercosis and treated with oral prednisolone and albendazole.

Discussion
Ocular manifestations may be devastating as the cysticercus enlarges. In the eye, the cysticerci may involve the intra-ocular or the extra-ocular tissues. The cysticerci have been reported to involve the vitreous body and the sub-retinal space (Lech, 1949; Reddy et al, 1980) as well as the anterior chamber and the sub-conjunctival space (Mehrotra and Sofat, 1975; Shea et al, 1973).

Ocular cysticercosis can be diagnosed by orbital imaging. The CT scan and MRI are helpful in diagnosing orbital and intra-ocular cysticercosis as well as to rule out neuro-cysticercosis.

In our patient, the cyst was present in the SR and LPS muscles complex and the patient responded well to systemic albendazole and steroid therapy.

Conclusion
Cysticercosis should be considered in patients with acquired blepharoptosis. It can be treated medically with oral steroid and albendazole.

References


Case report

Central Retinal Arterial Occlusion (CRAO) after Phacoemulsification - A Rare Complication

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Abstract

Background: While peribulbar anesthesia is generally safe, a remote risk of retinal vascular accident exists and its routine use should be done with caution. Objective: To report a case of central retinal artery occlusion (CRAO) that occurred within 24 hours of routine uneventful phacoemulsification cataract surgery using peribulbar anesthesia. We share our experience of a 45-year-old man who underwent uneventful clear corneal temporal incision phacoemulsification cataract surgery using peribulbar lignocaine injection with adrenaline. Case: A patient who underwent routine phacoemulsification surgery of left eye for posterior sub-capsular cataract under peribulbar anesthesia developed central retinal artery occlusion in the immediate post-operative period. The surgery was uneventful. Conclusion: Central retinal artery occlusion is a rare but dreadful complication seen after uneventful phacoemulsification and the cause is mainly due to anesthesia related.

Keywords: Central retinal artery occlusion, peribulbar anesthesia, phacoemulsification

Introduction

Effective anesthesia for major intraocular surgery in the past had been achieved using retrobulbar anesthesia. This technique, however, has an increased risk of direct damage to the optic nerve. Such damage includes central retinal artery occlusion (CRAO), combined CRAO and central retinal vein occlusion (CRVO) and anterior ischemic optic neuropathy (AION). These complications are thought to be due to direct needle penetration of the optic nerve, mechanical compression, drug toxicity, or from the effects of adjunct vasoconstrictor agents used in anesthetic solutions, among other causes (Klein ML et al, 1982). To reduce the incidence of such anesthesia-related complications, retrobulbar anesthesia has become largely replaced with other modalities such as topical, intracameral and peribulbar anesthesia. While these new modalities are much safer than retrobulbar anesthesia, a handful of complications have been reported in the literature.

In this report, we present a case of CRAO in a 45-year-old male patient who underwent uneventful phacoemulsification cataract surgery under peribulbar anesthesia.

Case report

A 45-year-old man presented with painless progressive diminution of vision in both eyes for 8 months. The best corrected visual acuities (BCVA) were 6/12 OD and counting finger close to face OS. Intraocular pressures (IOP) were 14 mmHg in each eye. Anterior segment evaluation revealed normal ocular findings except for posterior sub-capsular cataract in both eyes. Fundus assessment and other ocular examination findings were all normal. His general medical history was unremarkable and the physical examination normal. A diagnosis of both eyes posterior sub-capsular cataract of grade I in OD and grade IV in OS was made. The patient
was scheduled for OS phacoemulsification surgery. Before surgery, topical ciprofloxacin 0.3% was applied and a preparation of 4 ml lignocain 2 % in 1:100,000 adrenaline was injected through a single point in the lower eyelid immediately above the inferior orbital rim at the junction of the medial two thirds and lateral one third and running parallel to the orbital floor, 1cm into the peribulbar space, using a 25 G needle. The eye was compressed for 10 minutes using a pressure-reducing 'pinky ball'; the ocular surface was irrigated with 5 % povidone iodine and a universal wire speculum inserted. Phacoemulsification through clear corneal temporal incision of the left eye was performed. After the surgery 0.3 % ciprofloxacin ointment was applied and the eye lightly padded with eye shield ( a routine procedure for all surgical cases). At the first post-operative day, the patient complained of loss of vision in the operated eye. His BCVA was measured as hand motion (HM) close to face and the IOP 15 mmHg in the affected eye with relative afferent pupillary defect (RAPD). Funduscopy by indirect ophthalmoscope showed a whitened area of the entire retina most marked at the posterior pole, a classical cherry red spot and sluggish arterial blood flow. Scattered area of blot hemorrhage (figure 1) was also noticed. Fundus angiogram showed extensive area of capillary non-perfusion (figure 2). No peribulbar hemorrhage, lid hemorrhage nor proptosis was observed and extra ocular muscle movements were full. Tab acetazolamide 500 mg (250 mg x2) was given immediately with topical 0.5 % timolol maleate. The patient was put on routine topical steroid and antibiotic eye drops every two hours and tapered off gradually. The patient’s hemogram, fasting blood sugar and lipid profiles were all within normal limits. The systemic evaluation revealed no contributing factor. He was started on oral tablet of Aspirin 75 mg per day with antacid for one month and asked to be reviewed after 1 month.

Discussion

Peribulbar anesthesia is known to be safer but it still has the tendency to cause damage to the optic nerve through the remote effects of the anesthetic agent, amount injected, and speeds of injection and use of post-injection mechanical compression. Concurrent use of adrenaline in anesthetic agents is also known to cause vasoconstrictive effects that may lead to CRAO. Vinerovsky and co-workers suggested that while the event was likely to be caused by the vasospastic effects of adrenaline, it was also entirely possible to be caused by potential vasospasms in response to the anesthetic injection rather than the effects of the adrenaline. Such vasospastic effects of anesthetic agents used in local and regional blocks have been established in a number of other studies (Sullivan KL et al, 2013; 5 (10):281-283).
Findl et al (1999) reported a decrease in retinal blood flow velocity by 10 to 15%, one and five minutes respectively following peribulbar anesthesia without a vasoconstrictive agent like adrenaline (Klein ML et al, 1982). The group also established that such effect lasted between one to three days following a peribulbar injection for cataract surgery.

Occlusion of the central retinal artery may also be caused by increased IOP secondary to globe compression by the anesthetic agent and a subsequent weight placement on the globe. It is, however, known that extreme and prolonged increase in IOP (over the systolic arteriolar pressure) is needed to produce such retinal artery occlusion. Findl found no correlation between the high IOP and a decrease in retinal blood flow following peribulbar injection for cataract surgery (Findl et al, 1999). In this current report, the IOP remained within normal limits after completion of surgery as measured on the following day. In addition, the patient being reported on did not complain of postoperative pain which normally would accompany an acute rise in the IOP. Similar cases of retinal infarction with macular cherry red spot have been reported following intracocular injection of gentamycin and other amino glycosides aimed at preventing post-operative endophthalmitis. Many of such cases have had to do with either intravitreal injection or direct injection near areas of sclera thinning or laceration (Thomas et al, 2001). This scenario is unlikely as gentamycin was not used in this case.

The incidence of CRAO following peribulbar anesthesia suggests that damage to the optic nerve may occur even when the injection is away from the nerve. Immediate post-operative evaluation of retinal blood flow following peribulbar injection may help early detection and prompt treatment of CRAO. This is, however, difficult in practice due to the high number of cases of peribulbar anesthesia/surgery undertaken in most centres and the rarity of such a damage.

Conclusion

Central retinal artery occlusion after routine cataract surgery is unusual. We reviewed the literature on CRAO after routine intraocular procedures and proposed three hypotheses regarding the potential mechanisms involved. Although peribulbar anesthesia avoids direct optic-nerve injury, indirect injury presenting as CRAO may occur from vasoconstriction in response to the injection. A vasoconstrictive effect of the anesthetic agent on the central retinal artery, a rise in IOPs after anesthesia administration resulting in closure of the central retinal artery and a mechanical effect of the volume of anesthetic on the central retinal artery are considered as plausible mechanisms, with a mechanical effect being the favored hypothesis.

References


Dear Editor,

Conjunctival impression cytology is an easier, cheaper and faster non-invasive technique used as an alternative of biopsy to get epithelial cells from ocular surface. With the help of simple light microscope, special filter paper and Periodic Acid Shieff (PAS) or hematoxylin staining, epithelial cell information and goblet cell density can be determined easily. Moreover, ocular inflammatory markers, cytokinins, chemokinins, ocular mucin, HLA-DR, CE 23 and different gene expression can be investigated by applying different procedures such as immunoblotting reactions, polymerase chain reactions, immunocytochemistry or flow cytometry (Baudouin et al, 1997).

In the previous issue of Nepalese Journal of Ophthalmology, Kumar et al described a study on impression cytology in computer users (Kumar et al, 2013). Authors concluded that the computer use of more than one year duration makes abnormal conjunctival cytology. In that study with sample size of 15 computer users, all the subjects who use computer 4-6 hours a day, had 3rd or 4th stage of cytology. In addition to giving important information about the eyes of computer users, this report has raised a number of questions to be answered scientifically. However, a study with such a small sample size may not be strong enough to generalize its findings.

Studies with a greater sample size are necessary to identify the causes of cellular changes by computer use. The findings in this study are contradictory to the results of a recent study done by Mukhopadhyay et al (2013). In their cohort of 2000 normal people, (which was also conducted in India), the impression cytology was found to be of grade 1 in almost all of the office workers who work in computer 8 hours or more in a day.

Artificial lubricating drops were found to be helpful in improving the conjunctival cytology in dry eye patients (Aragona et al, 2002). Lubricating drops or reduction in computer hours may also improve the conjunctival cytology in the computer users.

Significant changes in conjunctival cytology have been found in contact lens wearers (Doughty and Naase, 2008). Most of the contact lens wearers use computer (Unpublished data, Nepal Eye Hospital). There might be serious changes in the conjunctival cytology of those subjects who wear contact lens and use computer most of the working hours.

We are carrying out a three-year single masked clinical trial on impression cytology in different types of contact lens wearers who work with computer for a varying duration of time. The findings of this study may help to answer some of these questions.
References


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Letter to the editor

Blepharoptosis and cysticercosis

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University, Nigeria; Visiting Professor, Faculty of Medicine, University of Nis, Serbia

Dear Editor

The recent report on ptosis and cysticercosis is very interesting (Labh et al, 2013). The
authors mentioned that that was a rare presentation of cysticercosis and also noted that “extra-
ocular cysticercosis could be treated with oral steroid and albendazole”. Indeed, cysticercosis
is a tissue infection and can be seen at any organ including the eyes. The ocular presentation of
cysticercosis is not extremely rare and should be kept in mind by all practitioners dealing with
any patients with eye complaints from endemic areas. Focusing on ptosis, there are many
previous reports on this symptom as the chief complaint of ocular cysticercosis. Generally, the
problem is usually unilateral and imaging technology can be helpful in presumptive diagnosis
(Basu et al, 2009; Malhotra et al, 2011). The problem is sometimes misdiagnosed as an
inflammatory disorder (Malhotra et al, 2011). However, it should be noted that not only
cysticercosis but also other soft tissue parasitic infestations including sparganosis and
gnathosomiasis can present as “ptosis” (Wiwanitkit et al, 2012).

References


5(9):133-135.


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