Delhi Journal of Ophthalmology

General Information

Delhi Journal of Ophthalmology (DJO), once called Visiscan, is a quarterly journal brought out by the Delhi Ophthalmological Society. The journal aims at providing a platform to its readers for free exchange of ideas and information in accordance with the rules laid out for such publication. The DJO aims to become an easily readable referenced journal which will provide the specialists with up to date data and the residents with articles providing expert opinions supported with references.

Contribution Methodology

Author/Authors must have made significant contribution in carrying out the work and it should be original. It should be accompanied by a letter of transmittal. The article can be sent by email to the Editor or a hard copy posted. Articles received will be sent to reviewers whose comment will be emailed to the author(s) within 4-6 weeks. The identity of the authors and the reviewers will not be revealed to each other by the editorial team. Detailed instructions to the contributors and for advertisement are included at the end of the journal.

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Published by
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Editor DJO,
Delhi Ophthalmological Society

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Information to Author
Dear Friends,

The job of the Chief Editor of any journal is not only interesting but challenging. As this is going to be my farewell editorial for Delhi Journal of Ophthalmology, with a heavy heart and the anxiety of saying goodbye to you, I would like to share with you some of the invaluable experiences of my journey as Editor DJO over the last two years.

Time and again in the past it was discussed and debated whether the Journal needs to be continued. But every time one or the other of my predecessors proved the critics wrong by keeping the journal alive. I take the opportunity to acknowledge and appreciate the efforts of each and every Ex-Editor of the journal for keeping the journal alive and kicking. It was only because the journal still existed that I could get the opportunity to work for it. It was because of the active support of all the DOS members that I could not only bring out all the issues of the Journal in time but could also maintain the shape of the journal. Over the last 2 yrs, the journal has grown and matured; thanks to the leadership of an effective editorial board and the outstanding support of the editorial committee members. I would like to pay my sincere gratitude towards the members who contributed their invaluable work to the journal. It was only because of their heartfelt involvement in the journal that we could bring the journal to this level. During this journey of two years a lot of hard work was done and energy pumped into getting the things into right direction and moving in the path of ongoing progress.

The introduction of the facility of the “Online submission of manuscript” not only raised the status of the journal but also paved the way to acquire higher number of manuscripts. Although rejecting an article is sad, but it only provides you the opportunity to raise the standards of the journal. Today we are in a position that we can reject some of the manuscripts which may not be of great academic importance for the readers. Importantly, all the articles comprising this new format for the journal have undergone peer review so that the highest scientific standards are maintained. All the manuscript that are being published in the journal has a unique digital object identifier (doi) number. One can access the manuscript by using these doi numbers. Further, our open-access strategy has allowed better visibility and dissemination of articles. The journal has now been indexed in the Indian Science Abstract. It is another achievement for which we can feel proud and happy. The journal has also been sent to Poland for final evaluation for indexing in Index Copernicus. Hopefully we will soon get the final nod from them.

The journal is standing on its own feet in terms of finances. The advertisements published in the journal and the subscription money provides enough collection so as to sustain the journal. The credit is all yours. It was because of your constant support and good quality articles and the frequent e-mails of encouragement that we could reach this stage. However, the job doesn’t end here. We have to keep improving the quality of articles being published and that is only possible if the members write and submit good quality manuscripts to the journal. Although my tenure finishes now, I’ll help the succeeding editors to the best of my ability to take the journal to new heights. I am absolutely sure that you all will also provide the same support to the incoming editors of the journal. Journal is the face of an academic body and we have to keep our face attractive. Once again, I thank you all for the immense support that I received as Editor DJO. The train whistle blows, and it is time to move to the window and say a last goodbye!

“Goodbyes are not forever. Goodbyes are not the end. They simply mean I’ll miss you until we meet again”.

Rajesh Sinha
MD, DNB, FIACLE, FRCS

DOI : http://dx.doi.org/10.7869/djo.2012.77
A Salute to Past Editors

Dinesh Talwar
(1995-1997)

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(1997-1999)

Arun Sangal
(1999-2001)

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Kamlesh
(2003-2005)

Ajay Aurora
(2005-2007)

Rajpal
(2007-2009)

Rohit Saxena
(2009-2011)

The above Academicians worked their heart and soul to keep the journal alive.

Had they not planted this sapling and nurtured it for so long we would not have reached so far reaping fruits of knowledge.

We Appreciate the Efforts of These Academicians !!!!
Major Review

Electrophysiology in Glaucoma - A Review

JL Goyal MD, DNB, Sudha Seetharam MS, Ritu Arora MD, DNB, Parul Jain MS

Abstract

Glaucoma is a slowly progressive disease which might lead to irreversible loss of vision if not detected and treated early. Early diagnosis of glaucoma remains a challenge to the clinician. It is conceivable that early nerve damage can be detected only by a test which is sensitive to its dysfunction before structural changes occur. The purpose of this review is to highlight the role of various electrophysiological techniques in the assessment and diagnosis of glaucoma.


Key Words: glaucoma, electrophysiology, ganglion cells.

DOI : http://dx.doi.org/10.7869/djo.2012.78

Glauc
oma is a multifactorial optic neuropathy characterized by progressive loss of retinal ganglion cells and their nerve fibres leading to characteristic loss of visual function. Significant loss of ganglion cells inevitably leads to visual disability but there is an inbuilt redundancy in the visual system which allows a large number of neurons to be lost without becoming manifest in standard tests of visual function. The techniques like routine testing of intraocular pressure (IOP), automated perimetry and optic nerve fibre layer photography fail to detect early glaucomatous damage. Ocular hypertensive eyes with no clinically manifest visual field loss or change in the appearance of the optic nerve head may have lost about 30% of the their axons.1 To summarize, early diagnosis of glaucoma remains a challenge to the clinician. It is conceivable that early nerve damage can be detected only by a test which is sensitive to its dysfunction before structural changes occur. Electrophysiological evaluation of optic nerve and retinal ganglion cell layer is one such diagnostic modality.

**Visual Evoked Potential (VEP) In Glaucoma**

Pattern visual evoked potential is recorded in response to reversing checker board stimulus where the background illuminance is kept constant. The potential of the optic nerve is recorded using surface electrodes placed on the occipital cortex. Pattern VEP has the following components

- A small negative wave the trough of which has a latency of around 75ms (N-75)
- A large positive wave the peak of which has a latency of around 90-110ms (P-100)
- A negative wave the trough of which has a latency of around 130-140ms (N-135)

Early reports of pattern VEP recording in glaucomatous eyes have come from Krogh et al,2 who artificially elevated IOP in experimental animal eyes. Recording of VEP was done prior to and after the elevation of IOP. Transient VEP amplitude drop was observed in response to elevated IOP. Atkin A et al reported an increase in latency of the positive wave (P-100) in glaucoma patients and ocular hypertensives as compared to normals.3 They also found that the latency in glaucomatous eyes was increased as compared to ocular hypertensives. But this conclusion could not find support from Grippo TM et al, who opined that there is not much change in latency of P-100 in glaucoma or ocular hypertension.4 Further the increase in latency could not correlate with the perimetric field loss. Thus they came to the conclusion that VEP is an indicator of retinal ganglion cell death rather than damage. Hence it is of little use in detecting early nerve dysfunction. Horn FK et al suggested that VEP with blue on yellow pattern stimulation may be useful in detecting early glaucomatous damage.5 This is based on the assumption that the short wavelength sensitive nerve pathway or the blue wave sensitive pathway is the earliest to be affected in glaucoma. Hence this S-cone VEP may pick up early changes not evident on conventional
VEP. Further, to bridge the gap between electrophysiology and perimetry multifocal recordings were introduced by Sutter and Tran. This allows simultaneous recording of VEP from 100 different points within the visual field. Klistorner et al reported generalized reduction in amplitude and increase in latency of VEP across the visual field. Moreover areas of scotoma in the visual field showed more change in VEP amplitude and latency as compared to other areas. To summarize, conventional pattern VEP can detect only established glaucoma but newer modifications like S-cone VEP and multifocal VEP may be used to diagnose early disease and monitor progression.

**Pattern Electroretinogram In Glaucoma**

Pattern electroretinogram (PERG) is recorded in response to reversing checkerboard stimulus (reversal rate<6 pps) where the mean luminance is kept constant. The retinal potential is recorded with the help of corneal electrodes like gold foil electrode or H-K electrodes. The waveform of PERG shows the following components;

- A small negative wave the trough of which is obtained at around 35ms (N-35)
- A large positive wave the peak of which is obtained at around 45-60ms (P-50)
- A large negative component the trough of which lies at around 90-100ms (N-95)

![Figure 2 Normal Pattern ERG](image)

The first studies of PERG recording in glaucomatous eyes by May et al, Wanger et al all reported a significant reduction in amplitude of PERG as compared to normal reference values as well as opposite eyes of the same patient. Ringens PJ et al further reported an increase in latency in PERG in glaucoma along with a decrease in amplitude. Weinstein GW et al found a selective reduction in the second negative wave (N-95) of PERG in glaucomatous patients and concluded that this wave (N-95) is related to early optic nerve dysfunction. This opinion was further strengthened by Arai M et al whose study concluded that decrease in amplitude of the second negative wave(N-95) is a warning sign of development of glaucoma in ocular hypertensives. The most comprehensive reports of PERG abnormalities in glaucoma came from Holder et al who concluded that the N-95 component is generated by the retinal ganglion cell layer and that the P-50 component is generated by the inner and outer retinal layers and macula. Following this, studies were directed at establishing correlation between PERG and other regularly conducted tests of glaucoma. Neoh C et al reported significant correlation between PERG amplitude (P-50 and N-95) and the global indices (mean deviation and corrected pattern standard deviation) of Humphrey’s visual field analyzer. This however could not find support from Hood CD et al who conducted a study of PERG in glaucoma patients of visual field defects. They measured not only the amplitude of N-95 but also the N-95/P-50 ratio and their relationship with the global indices of automated perimetry. The amplitude of P-50 was measured from the trough of N-35 to the peak of P-50. Similarly the amplitude of N-95 was measured from the peak of P-50 to the trough of N-95. The study concluded that significant reduction in amplitude of N-95 as well as N-95/P-50 ratio (normal 1.2-1.9) is seen in glaucomatous eyes but no linear relationship could be established with perimetric field loss. In order to bridge the gap between electrophysiological tests and perimetry multifocal recordings introduced by Sutter and Tran were employed. This allows simultaneous recording of ERG from 100 regions within the visual field. This is based on the assumption that PERG analyses only the central degrees of the visual field whereas the common field defects beyond this central zone can only be assessed by multifocal recording. However, Klistorner et al reported that though generalized reduction in amplitude of multifocal ERG across the visual field is observed in glaucoma, no localized ganglion cell loss corresponding to visual field defects could be identified.

To summarize, PERG is a useful tool for early detection of glaucoma preceding the appearance of visual field defects. However the correlation of PERG with visual fields is difficult to ascertain. The main problem of PERG is not its interpretation but the process of recording itself. It requires refractive correction, clear ocular media, good patient cooperation for proper placement of electrodes because even a small reduction in the quality of the retinal image can cause significant reduction in the amplitude of PERG leading to erroneous results.

**Photopic Negative Response In Glaucoma**

The conventional flash electroretinogram (ERG) recorded with corneal electrodes in response to flash stimuli by Ganzfield stimulator has not received much attention in glaucoma. This is because it was believed that the components of flash ERG originate from the photoreceptors and bipolar cells of the retina which are not much affected in glaucoma. Thus use of flash ERG was limited to detection of diseases like retinitis pigmentosa, cone dystrophy, ischaemic retinal vein occlusions etc. Recent interest in flash ERG has been
generated due to the identification of a new wave named photopic negative response (PhNR) which is believed to originate from the retinal ganglion cell layer and hence may be useful in detecting early nerve dysfunction in glaucoma. The components of the conventional flash ERG are:

- A small negative ‘a’ wave believed to originate from the photoreceptors
- A large positive ‘b’ wave believed to originate from the Muller’s cells and bipolar cells
- A non-specific ‘c’ wave originating from the retinal pigment epithelium

The components of the conventional flash ERG are:

![Figure 3 Normal Flash ERG](image)

Flash ERG recorded under photopic conditions specified by International Society for Clinical Electrophysiology of Vision (ISCEV) identifies a new component named photopic negative response (PhNR)

- PhNR is the negative wave following the ‘b’ wave
- The amplitude of PhNR is measured from the baseline to the trough of the wave

![Figure 4 Photopic Negative Response](image)

Photopic negative response has been measured in rat eyes after optic nerve transection and intravitreal injection of tetradoxin which is a blocker of the neural activity of the retinal ganglion cells. PhNR was found to be strongly attenuated in these eyes as compared to normals. About 56% reduction in amplitude was found after optic nerve transection and about 57% reduction was seen 30 minutes after intravitreal injection of tetradoxin. This study by Li et al demonstrated that PhNR depends on the integrity of retinal ganglion cell layer and hence may have a role to play in glaucoma detection. In addition, it has been reported that the PhNR is selectively attenuated in eyes with optic nerve atrophy induced by trauma, compression, inflammation, gene mutation, and ischemia.

Colotto A et al reported significant reduction in amplitude of PhNR (average 62%) in primary open angle glaucoma (POAG) as compared to normals. Similarly, Vishwanathan S et al, in a study of 62 normals, 18 POAG patients and 7 POAG suspects demonstrated that the amplitude of PhNR was greatly reduced in the POAG group as well as the suspect group in comparison to normals. They also found that the amplitude of PhNR correlated significantly with the mean deviation of the visual fields and the cup:disc ratio of the optic nerve head. Shigeki M et al reported a decrease in PhNR/b wave ratio in glaucomatous eyes with an increase in visual field defects. The amplitude of PhNR and PhNR/b wave ratio correlated significantly with the retinal nerve fibre layer thickness (RNFLT), the rim area of the optic disc and the cup/disc area ratio when expressed logarithmically.

However, Jones AL et al reported a reduction in amplitude of PhNR in glaucoma but not in ocular hypertensives (OHT) when compared to normals. POAG patients, 13 patients and 22 controls were included in their study in which they recorded PERG and PhNR according to international society for clinical electrophysiology of Vision (ISCEV) standardized conditions. Compared to controls, both POAG and OHT groups showed significant reduction in the amplitudes of PERG N95 as well as PhNR. In the POAG group, some correlation was found between the amplitudes of PERG N95, PhNR, optic disc topography and retinal nerve fibre layer thickness. No significant correlation was seen in the OHT group. They concluded that the modest correlation between the structural and electrophysiological measures in glaucoma suggest that they identify different aspects of the pathological process. Similar results were reported by Zaschi et al who recorded PhNR in cases of normal tension glaucoma and found significant reduction in amplitude as compared to normals but no correlation could be found between PhNR amplitude and visual field defects or cup:disc ratio. Interestingly, Claus et al did not find any significant reduction in the amplitude of PhNR even in the presence of advanced glaucoma. They studied 18 cases of advanced glaucoma and 9 controls but demonstrated that the amplitude of the negative response was not significantly reduced in glaucomatous eyes as compared to normals.

Todorova MG et al reported that it is the latency rather than the amplitude of PhNR which is affected in glaucoma. They studied 15 patients of high tension glaucoma (HTG), 15 patients of normal tension glaucoma (NTG) and 15 normals and observed an increase in latency in HTG and NTG group as compared to normals but the latency delay was more sensitive for HTG than for NTG. Thus, we see that
being a relatively newer investigative tool, the behaviour of PhNR in glaucoma is still under debate and studies are still being conducted to establish its role in glaucoma diagnosis. Different schools of thought also exist regarding the method of recording of PhNR. Conventionally, PhNR is described by recording visual response to a red flash (650nm) on a white background (450nm). This is presumed to relate to the long (L) and medium (M) wavelength sensitive cone pathways. It is known that the blue or short (S) wavelength sensitive cone pathway is the earliest to be affected in glaucoma. This pathway which is investigated using short wavelength automated perimetry (SWAP) can be assessed electrophysiologically using S-cone PhNR. A blue flash on a yellow background is used as stimulus to obtain this response which is known as the S-cone PhNR. Drasdo et al compared the sensitivity of S-cone PhNR and L&M cone PhNR with PERG in early POAG.29 It was seen that the amplitude of both L&M PhNR and S cone PhNR were reduced in glaucoma as compared to normals but the latter was the more sensitive test providing the most statistically significant results. They concluded that the extensive damage to the S cone bipolar and ganglion cells which occur in early POAG owing to a pressure related mechanism is actually detected by S cone PhNR. However, Wakili et al conducted a pilot study in 10 patients of asymmetrically advanced glaucoma between the two eyes using white flash on a white background. Comparison was done between the two eyes of the same patient. They concluded that the amplitude of PhNR was reduced significantly in glaucoma even if a white stimulus on white background is used.30 Goto Y et al recorded PhNR in 10 patients of optic nerve atrophy induced by various etiologies by providing a white stimulus on a white background.31 They found significant reduction in amplitude of PhNR in cases of optic atrophy as compared to normals. From this they concluded that even a white stimulus on a white background may elicit PhNR as long as the recordings arise from the photopic system.

The main advantage of this test over Pattern ERG is that it can be recorded even in patients with poor co-operation and hazy ocular media. The only requirement is the presence of a dilated pupils.  

Electrophysiological Evidence of Early Functional Damage in Glaucoma and Ocular Hypertension

In a study done by North et al32 in patients with ocular hypertension and glaucoma, 30 subjects under treatment for open-angle glaucoma, 23 subjects with ocular hypertension, and 28 healthy subjects in a control group were investigated by monocular ERG, L&M cone ERG, and S cone ERG. All types of ERG had reduced mean amplitudes in OHT and POAG groups compared with the control group. In the ocular hypertension group, the N95 and the L&M-pathway PhNR were significantly attenuated (by 19% and 18% in OHT group compared with the control group, respectively; by 30% and 22%, respectively, in the open-angle glaucoma group compared with the control group). In the subjects with open-angle glaucoma, the pattern ERG P50-N95 was found to be the most sensitive electrophysiological test, and the cup-disc area ratio, when examined by scanning laser ophthalmoscopy, was the most sensitive imaging parameter. They concluded that electrophysiology can be used to quantify retinal ganglion cell dysfunction that occurs before cell death.

References

Multiple Sclerosis – An Ophthalmologist’s perspective

Reena Sharma¹ MD, DNB, Rohit Saxena¹ MD, Rohit Bhatia² MD, DM, DNB, Vimla Menon¹ MS

Abstract

Multiple sclerosis is a nervous system disease that affects brain and spinal cord. It damages the myelin sheath, the material that surrounds and protects the nerve cells. Its symptoms are varied and unpredictable. It commonly affects the optic nerve and ocular movements. Up to 50% of patients with multiple sclerosis will develop an episode of optic neuritis, and 20-30% of the time optic neuritis is the presenting sign of multiple sclerosis. Optic neuritis is diagnosed clinically and followed up using visual acuity, colour vision, contrast sensitivity, visual fields, magnetic resonance imaging and optical coherence tomography. Bilateral internuclear ophthalmoplegia, abnormalities resulting from cerebellar damage or to its connections and pendular nystagmus are other common ophthalmic manifestations of the disease. Multiple sclerosis is diagnosed using McDonald criterion, based on the occurrence of at least two clinical episodes of neurological involvement separated in time and space. The magnetic resonance imaging aids the diagnosis and requires the presence of lesions in at least 2 of the four locations- periventricular, juxtacortical, infratentorial and spinal cord. The treatment of multiple sclerosis is multidisciplinary, involving the treating physician, physiotherapists, occupational therapists, nurses and social workers. There are no drugs to cure multiple sclerosis, but several therapies are available that can ameliorate the symptoms of multiple sclerosis and, in some cases, slow the disease progression.

Key Words: optic neuritis, myelin sheath, internuclear ophthalmoplegia
DOI : http://dx.doi.org/10.7869/djo.2012.79

Multiple sclerosis (MS) is the most common disabling neurological disease in young adults. It is a demyelinating disorder of the central nervous system (CNS) that causes progressive neurodegeneration over time. The pathogenesis of MS is considered to be due to autoimmune mechanisms that target both white and gray matter elements, and is characterized by demyelination, gliosis, axonal damage, and neuronal loss in the brain and spinal cord.

The risk of developing MS is about 1:1000 in the general population. This increases to 30:1000 (2% to 4%) in first-degree relatives of patients with MS. The concordance rate is approximately 30% in monozygotic twins.

Pathology of MS

Multiple sclerosis is mainly characterized by inflammatory demyelination and gliosis. The histopathologic hallmark of the disease is the perivenular inflammation, predominantly affecting the white matter of the brain and spinal cord. These infiltrates consist of T and B lymphocytes and macrophages. Chronic plaques typically exhibit myelin destruction, disappearance of oligodendrocytes, and astrocyte proliferation. The initial trigger for the disease process has not yet been identified. The cause is unclear, but MS is likely an autoimmune process that occurs in genetically susceptible individuals following an environmental exposure. An immune cross reaction to central nervous system myelin antigens has been implicated.

Ophthalmic Manifestations of MS

MS can involve the afferent visual system and the ocular motor system, with a full range of abnormalities depending on the location of the demyelinating lesions. (Table 1) The most common ophthalmic presentation is in the form of acute demyelinating optic neuritis (ON). Although almost any type of ocular motor abnormalities have been reported, the commonest ones are bilateral internuclear ophthalmoplegia (INO), abnormalities resulting from cerebellar damage or to its connections and pendular nystagmus.

Optic Neuritis

It is a clinically isolated syndrome (CIS) and presents as an acute inflammation of the optic nerve causing painful loss of vision. ON is the first clinical manifestation of MS in approximately 20% of the cases and an additional 30% to 70% of the patients of MS develop ON during the course of their disease.
TABLE 1. Ophthalmic Manifestations of Multiple Sclerosis

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</table>

**Clinical presentation**

Optic neuritis commonly occurs between the ages of 15-49 years (mean age 30-35 years).\(^6\) It is diagnosed clinically based on history and examination. Adult patients with ON often present with unilateral acute or subacute decline of visual acuity. Vision loss peaks at about 10 days followed by improvement. Bilateral involvement can occur, but this is more common in children or in neuromyelitis optica (NMO). Colour vision is affected before any decline of vision occurs, with colours appearing ‘washed out’. There is often orbital pain in or around the eye, which is typically described as dull ache and increases with extraocular movement. Pain can either precede or occur simultaneously with subacute unilateral visual loss. Optic neuritis can present in three forms - acute, recurrent and chronic. Acute optic neuritis has a typical presentation as described above. These episodes may occur repeatedly to be labeled ‘recurrent optic neuritis’. This is similar to the ‘relapses’ of MS, but do not by themselves constitute MS because they are not separated in space/site. The vision and other optic nerve parameters improve after each episode, though residual deficits tend to accumulate with each attack. Subclinical axonal loss and visual abnormalities can occur in MS patients in the absence of acute demyelinating episodes. These patients of chronic optic neuritis may complain of a static disturbance of vision, a slowly progressive loss of vision in one or both eyes, or, occasionally, a stepwise loss of vision unassociated with periods of recovery. Not every patient who has an episode of optic neuritis goes on to develop MS. The ten-year risk of developing clinically definite MS following a single episode of optic neuritis was 38% and the twelve-year risk was 40% in the follow-up from the Optic Neuritis Treatment Trial (ONTTT). Most of those who developed MS did so within the first five years after the initial episode of optic neuritis. The strongest predictor of MS in the study group was the presence of brain lesions on MRI at the time of the episode of optic neuritis. The patients with at least one brain lesion on MRI at the time of the ON episode had a 56% risk of developing MS within 10 years, while those with no brain lesions had only a 22% risk of developing MS within 10 years.

**Tools for diagnosis and follow up of optic neuritis**

- **Visual acuity**: Acute ON presents with sudden onset loss of visual acuity that can worsen over hours to days. Visual acuity in ON can range from 6/6 to no perception of light. Though this recovers almost fully after each episode, there is an accumulation of residual deficits with recurrent episodes of ON.

- **Colour vision and contrast sensitivity (CS)**: CS can detect silent lesions of the visual pathways in MS and may prove to be more sensitive than visual evoked potentials.\(^9\) There are no characteristic colour defects in ON, but they occur early in the disease and persist long after the acute demyelinating episode.

- **Visual fields**: Visual field loss of some extent is universal in ON. The perimetry helps to quantify the depth of visual field loss, identify atypical cases of optic neuritis, and may aid in counseling patients about prognosis.\(^10\) In the ONTT, patients underwent central (Humphrey Visual Field Analyzer full-threshold strategy of the central 30-2) and peripheral field examination (Goldmann kinetic perimeter). Visual fields were obtained at baseline and at seven follow-up visits in 6 months and then yearly. 100% of the affected eyes and 69% of the fellow eye showed visual field abnormalities. Visual field defects in the affected eye at presentation included diffuse visual field loss (48%), altitudinal defects (15%), central or cecocentral scotoma (8.3%), arcuate or double arcuate (4.5%), hemianopic defects (4.2%), and others.\(^11\) At final 15 yr follow-up, patients who developed multiple sclerosis were more likely to have abnormal visual functions including visual fields.\(^12\) A comparison of the visual field data obtained by the standard automated perimetry and the kinetic perimeter showed that the peripheral visual field defects were less severe and recovered more rapidly as compared to the central visual field defect.\(^13\)

- **Optical coherence tomography (OCT)**: OCT is a reliable means of evaluating the retinal nerve fiber layer (RNFL) changes representing anterior visual pathway injury in a patient of ON. During the acute phase of optic neuritis, the peripapillary RNFL may show increased thickness in papillitis and no change in retrobulbar neuritis.
Internuclear Ophthalmoplegia (INO)

INO is a horizontal gaze abnormality characterized by impaired adduction of the involved eye, often associated with nystagmus of the contralateral abducting eye. It is due to a lesion of medial longitudinal fasciculus in the brainstem. Convergence is typically preserved, though it may be lost in more rostral bilateral lesions affecting convergence pathways or the medial rectus subnuclei. Then the eyes appear divergent in primary gaze producing the so-called ‘wall-eyed’ bilateral INO. INO is detectable clinically in 15–38% of patients with MS.\(^5\) MS is a common cause of INO, second only to infarction, accounting for 34% of cases in one large series.\(^6\) While infarction typically results in unilateral INO, MS often causes bilateral INO. Most patients (61.9%) with INO secondary to a demyelinating lesion will have complete recovery, in contrast to INO from vascular or other pathologies.

MR Imaging of Brain and Spinal Cord

The demyelinating lesions of MS can be seen in multiple locations including the periventricular zones, the centrum semiovale, corona radiata, corpus callosum, within the brainstem, and at the juxtacortical zones in the MRI of brain.\(^2\) The McDonald diagnostic criterion requires the presence of lesions in at least 2 of the four locations - periventricular, juxtacortical, infratentorial and spinal cord. Cerebral white matter lesions are often oriented perpendicular to the long axis of the ventricles (called ‘Dawson’s fingers’). The lesions enhance following gadolinium infusion which signifies a breach in the integrity of the blood-brain barrier. The lesions in the spinal cord have a cigar-like shape and typically span one or two spinal cord segments. There is a higher predilection for the involvement of cervical than thoracic cord segments. T1 weighted sequences of MRI following gadolinium based contrast injection shows enhancement within the optic nerve in 95-100 % of the optic neuritis cases. Brain MR imaging has been demonstrated to be a strong predictor of development of MS among patients with acute optic neuritis. The 5-year incidence of MS in patients who had abnormal brain MR imaging at the time of optic neuritis was 51% compared with a 16% in those with normal brain MR scans in the ONTT study group.\(^20\) This predictive value of MRI is important in patient counseling.

Classification of MS

1) Relapsing-remitting (RR) MS - It constitutes about 85% of the MS patients. Acute episodes of neurological symptoms occur, which last for days, weeks or months before completely or partially resolving. The intervals between attacks can vary widely but, on average, occur every one to two years. Majority of them later convert to secondary progressive type of MS.

2) Secondary progressive (SP) MS – It is characterized by a steady, insidious progressive deterioration of neurological function, with or without ongoing relapses. This latter form of MS most commonly produces disability with features most consistent with myelopathy, including a decline in ambulation, spasticity, and bladder and bowel dysfunction.

3) Primary progressive MS (PPMS) - It represents only about 10% of the MS population and involves a steady disease from the onset, not associated with relapses.

4) Clinically isolated syndrome (CIS) – These constitute patients with clinical features suggestive of involvement of a single site of CNS. Optic neuritis is the most common CIS. These may or may not develop clinically definite MS.

5) Progressive relapsing MS - The disease starts as progressive form of MS and then develop superadded relapses. It is the rarest variety.

Diagnosis of MS

The diagnosis of MS is clinical, based on the occurrence of at least two clinical episodes of neurological involvement separated in time and space. However, neuroimaging adds to the diagnosis. Since the early 1980s the Poser criteria was used to classify multiple sclerosis. This relied on evidence of at least two relapses typical of multiple sclerosis and evidence of involvement of white matter in more than one site in the central nervous system, the concept of “lesions scattered in time and space.” Advances in paraclinical investigations, such as cerebrospinal fluid studies, visual evoked potentials, and MRI, have led to more permissive diagnostic criteria that have increased the sensitivity and specificity of diagnosis. A new system of classification, the McDonald criteria, incorporates both clinical and laboratory elements, allowing an earlier confirmation of the diagnosis and thus enabling earlier decisions about starting disease modifying therapies.\(^21,22,23\) (Table 2)

An attack (relapse; exacerbation) is defined as patient-reported or objectively observed events typical of an acute inflammatory/demyelinating event in the CNS, current or
historical, with duration of at least 24 hours, in the absence of fever or infection. It should be documented by a clinical examination. In addition, the two episodes have to occur at a gap of at least 4 weeks to label them as separate attacks.

**Treatment**

Treatment in MS patients consists of treatment of acute attacks, prevention of relapses and progression, manage symptoms, and rehabilitate the patient.

**Treatment Of Acute Optic Neuritis**

A patient with acute optic neuritis is given IV steroids (IV methylprednisolone sodium succinate 250 mg every 6 hours) for 3 days followed by oral prednisolone (1 mg/kg per day) for 11 days. Use of steroids have shown a modest effect on the speed of recovery from an acute attack though there is no change in eventual deficit or disability. An oral taper, however, is not normally necessary as this short treatment is unlikely to suppress the hypothalamic-pituitary axis. We use intravenous dexamethasone instead of methylprednisolone as it is equally efficacious and cheaper. The nature and the duration of subsequent treatment of these patients are still unclear. Imaging should be done. If we are able to diagnose MS using McDonald criterion, they should be treated as MS patients.

Two recent prospective, randomized, placebo-controlled phase III clinical trials (class I evidence) demonstrated that clinically isolated syndromes patients with evidence of silent lesions present on MRI of the brain significantly benefited from treatment with interferon (IFN) beta-1a (Avonex or Rebif) compared with placebo-treated patients.

**Treatment of MS**

Most exacerbations/attacks are self limited. The attacks causing weakness or incoordination are usually treated with a short course of high-dose intravenous methylprednisolone
as for optic neuritis. Other treatment options that are rarely used for acute attacks in relapsing–remitting disease include intramuscular adrenocorticotropic hormone (ACTH) and intravenous immune globulin. Plasma exchange may be used in patients with severe neurologic dysfunction poorly responsive to corticosteroids. Large randomized clinical trials have shown that drugs can reduce the number and severity of relapses, reduce the number of new lesions appearing on MRI, and probably reduce long term progression of multiple sclerosis. The disease modifying drugs approved by Food and Drug Administration/European Medicines Agency are given in table 3. They are the mainstay of treatment of MS.

Currently, most disease-modifying agents have been approved for use only in relapsing forms of MS. Mitoxantrone is also approved for the treatment of secondary (long-term) progressive and progressive relapsing MS. These drugs have been shown to reduce the frequency of exacerbations and slowed the rate of appearance of new white matter lesions on MRI.

However, side effects are common with most of these drugs. Flu like symptoms is the most commonly encountered side effect of interferons. Some interferon-treated patients develop neutralizing antibodies that can result in reduced effectiveness of these medications (least with Avonex). Fingolimod is the recently approved drug for oral use available for the treatment of MS. 0.5 -0.6% of the patients using this drug develop macular edema. Natalizumab can cause PML (progressive multifocal leuconecephalopathy) which has a propensity for affecting visual cortex and optic radiation and present with homonymous hemianopia. It therefore remains a second line drug for treatment of MS patients. The drug mitoxantrone is approved for patients with more advanced disease. This drug is however limited by the potential side-effects of cardiotoxicity and secondary leukemia.

**Adjunctive Agents**

They are used in patients with progressive relapsing-remitting and secondary progressive multiple sclerosis whose symptoms are worsening despite treatment with disease modifying drugs. The commonly used adjunctive treatments are:

i. IV Immunoglobulin
ii. Azathioprine
iii. Methotrexate
iv. Cyclophosphamide

These treatments also have many significant side effects and have to be given under the care of a neurologist. Although therapy for clinically isolated syndrome (a single episode of neurologic symptoms) with immunomodulatory medications has not yet become standard practice throughout the world, trials suggest that early intervention may be appropriate.

MS is thus a disease of the central nervous system for which there is, as yet, no cure. It is of huge neuroophthalmological importance. We, as ophthalmologists need to have a good idea of the disease to manage and follow up these patients.

**References**

Echo Graphic Evaluation of Retinoblastoma and its Management Modalities

Kushal S Delhiwala MBBS, Hansa H Thakkar MS

Abstract

**Aim:** To establish efficacy of echography in diagnosis of Retinoblastoma and study the outcome of different management options.

**Material and Methods:** Retrospective evaluation of data of 100 Retinoblastoma patients for demographic data, clinical presentations, B scan (10MHz) ultrasonography (USG) findings, treatment outcome and follow up examination was carried out. Histopathology was correlated.

**Results:** Out of 100 patients from 4 months to 6 years, 57 % were male and 43 % female. Fifty six percent patients were in age group of 1-3 years. Total 148 eyes of 200 had Retinoblastoma. Leucocoria (75, 51%) was the commonest presentation followed by ocular swelling/proptosis (29, 20 %). Histopathology confirmed the diagnosis in all enucleated eyes. Five patients had no calcification in either eye. Thirty three patients showing mass in 43 eyes could be followed up from 6 months to 4 years. Of 18 enucleated eyes, 2(11%) showed regrowth that responded to radiation therapy. Out of 28 eyes receiving laser and/or chemotherapy, (10.7 %) eyes had full regression, 10(35.7 %) partial regressions, 3(10.7 %) became atrophic, 3(10.7 %) showed progression, 1(3.6%) had regrowth in enucleated eye.

**Conclusion:** Outcome of chemotherapy and laser in retinoblastoma management is promising but not predictable in all patients. They need to be monitored regularly for a long time. Role of echography to diagnose and monitor such patients is indispensable. Enucleation has important role in retinoblastoma management.


**Key Words:** retinoblastoma, echography, chemotherapy, leucocoria

DOI: http://dx.doi.org/10.7869/djo.2012.80

Retinoblastoma is a scary, deadly, blinding ocular malignancy. It is the most common intraocular malignancy in children, with a reported incidence ranging from 1 in 15,000 to 1 in 18,000 live births.¹ There is no racial or gender predisposition. Retinoblastoma is bilateral in about 25 to 35% of cases. The average age at diagnosis is 18 months, unilateral cases being diagnosed at around 24 months and bilateral cases before 12 months.²

Figure 1: Clinical presentation of Retinoblastoma patient; Figure 1(b&c): B-scan USG; A-scan USG

A thorough clinical evaluation with careful attention to details, aided by ultrasonography (USG) B-scan helps in the diagnosis. Computed tomography (CT) and magnetic resonance imaging (MRI) are generally reserved for cases with atypical manifestations and diagnostic dilemma and where extra ocular or intracranial tumor extension is suspected.³
USG B-scan shows a rounded or irregular intraocular mass with high internal reflectivity representing typical intralesional calcification. In addition, the calcific mass shadows the sclera and orbital soft tissues posteriorly. On reducing the gain of the instrument, the reflections from the calcific particles within the tumor persist. (Figure 1)

**Figure 2**: Age distribution of patients

**Figure 3(a)**: Clinically leucocoria with strabismus; **Figure 3(b)**: B-scan showing Retinoblastoma

USG B-scan shows a rounded or irregular intraocular mass with high internal reflectivity representing typical intralesional calcification. In addition, the calcific mass shadows the sclera and orbital soft tissues posteriorly. On reducing the gain of the instrument, the reflections from the calcific particles within the tumor persist. (Figure 1)

The management of retinoblastoma needs a multidisciplinary team approach. The strategy depends on the stage of the disease and is highly individualized. The treatment options available include focal therapy in the form of cryotherapy, laser photocoagulation, trans pupillary thermotherapy and brachytherapy; local therapy like enucleation and external beam radiotherapy and systemic chemotherapy as combination of vincristine, etoposide and carboplatin.

**Aim**

The study was carried out with an aim to establish efficacy of echography in diagnosis of Retinoblastoma and its different management options.

**Material and Methods**

Retrospective evaluation of data of 100 patients diagnosed to have Retinoblastoma at ultrasound clinic from March 2007 to March 2012 was carried out. Demographic
data, clinical presentations, B scan (10MHz) USG findings, treatment outcome and observations on follow up examinations were recorded. Fundus findings were noted & histopathology was correlated. Children below six years of age, referred to ultrasound clinic for various presentations and diagnosed to have retinoblastoma on USG were included in the study. Children above six years of age were excluded.

**Results**

Out of 100 patients examined, 57 % were male and 43% female. Age ranged from 4 months to 6 years, with 56% patients presenting in age group of 1-3 years, 12 % patients below 1 year and 32% patients 4-6 years. (Figure 2) Out of 12 patients below 1 year, 9 (75%) were having bilateral and 3 (25%) were unilateral retinoblastoma. Total 148 of 200 evaluated eyes were diagnosed to have Retinoblastoma. Retinoblastoma was bilateral in 48 % patients, while 52 % had unilateral retinoblastoma. In patients with unilateral lesion, in 22 (42.3%) right eye was involved while in 30 (57.7%) left eye was affected.

The commonest clinical presentation was leucocoria (75, 51%) followed by ocular swelling/proptosis (29, 20 %) and strabismus (14, 10%). One patient had hypopyon with...
The clinical diagnosis of retinoblastoma was missed as cataract in 10, Coats’ disease in 3, glaucoma in 3, panophthalmitis in 2 and uveitis in 2 eyes. Ultrasonography could establish diagnosis of retinoblastoma in all those 20 patients. (Figure 6) Twenty seven (27%) patients presented with uniocular symptoms had growth in both the eyes on USG. Eighteen eyes were enucleated. Histopathology confirmed the diagnosis of retinoblastoma in all enucleated eyes. Five patients had no calcification in either eye, 2 of which showed poorly differentiated round cells. Thirty three patients showing mass in 43 eyes could be followed up from 6 months to 4 years.

Of 18 enucleated eyes, 2(11%) showed re-growth of which 1 eye was not treated with adjuvant chemotherapy post enucleation. Both of them responded to radiation therapy. Out of 28 eyes receiving laser and/or chemotherapy pre- or post-enucleation, 3(10.7 %) eyes had full regression, 10(35.7 %) partial regressions, 3(10.7 %) became atrophic, 3(10.7 %) showed progression, 1(3.6%) small mass showed no effect. (Figure 7)

### Discussion

Leucocoria (51%), was the commonest presentation in our study. It is similar to the incidence stated by Abramson DH et al (56%). However; presentation with orbital cellulitis in form of proptosis/swelling was higher (20%) in our study as compared to their report (3%). This is because of lack of awareness leading to late presentation of patients in our country. Incidence of strabismus was less (10%) with us as compared to their study (20%). Maximum patients (56%) presented in age group of 1-3 years. Shields et al, stated that bilateral retinoblastoma cases present before 12 months. In our series only 19 % patients with bilateral lesion presented below one year.2 Twenty seven (27%) patients presented with uniocular symptoms had growth in both the eyes on USG. This shows how efficiently this cost effective procedure can diagnose the mass. In our study, 5 % patients showed no calcification on USG, which is otherwise considered to be the characteristic feature of retinoblastoma. This is similar to that observed by William Tasman et al, who stated that not all retinoblastoma tumors become calcified.5 In our study, 35.7 % showed partial regression, 10.7 % showed progression & 3.6 % had no effect of chemotherapy & laser treatment. On the contrary, 5.5% though treated with adjuvant chemotherapy showed regrowth following enucleation. This is due to presence of the high risk factors & highly undifferentiated tumor mass as stated by Gunduz K et al.6

Full regression of mass was noticed in 10.7 % patients, while another 10.7 % showed atrophy following combined therapy. Thus, chemo reduction combined with focal therapy is effective for selected eyes with retinoblastomas as stated by Shields et al & De Potter P’et al. However, close

### TABLE 1 Presentations of patients

<table>
<thead>
<tr>
<th>Presentation</th>
<th>No. of diseased eyes (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leucocoria</td>
<td>75 (51 %)</td>
</tr>
<tr>
<td>Proptosis</td>
<td>29 (20 %)</td>
</tr>
<tr>
<td>Strabismus</td>
<td>14 (10 %)</td>
</tr>
<tr>
<td>Glaucoma</td>
<td>3 (2 %)</td>
</tr>
<tr>
<td>Uveitis</td>
<td>2 (1.3 %)</td>
</tr>
<tr>
<td>Red eye</td>
<td>2 (1.3 %)</td>
</tr>
<tr>
<td>Vitreous hemorrhage</td>
<td>2 (1.3 %)</td>
</tr>
<tr>
<td>Pseudo hypopyon</td>
<td>1 (0.7 %)</td>
</tr>
</tbody>
</table>
follow-up of all patients treated with chemo reduction is warranted.7,8 (Figure 8)

The nightmare of retinoblastoma can become a fairy-tale with early detection of cancer and better therapeutic regimens. Parents are needed to notice the symptoms and bring the children to the hospitals at the earliest so that intervention is provided when we can save the child’s life and eye and provide reasonable vision for a lifetime.

Conclusion

Outcome of chemotherapy and laser in retinoblastoma management is promising but not predictable in all patients. They need to be monitored regularly for a long time. Role of echography to diagnose and monitor such patients is indispensable. Enucleation has important role in retinoblastoma management

References

Comparision of Ultrasound Biomicroscopic and Gonioscopic Features of Angle In Pre & Post Laser Peripheral Iridotomy Patients of Primary Angle Closure Glaucoma

Vaishali A Prajapati MS, Viral Rana MS, Mariam N Mansuri MS, Purvi Bhagat MS, Kamini Prajapati MS, Nirav Modi MS

Abstract

Purpose: To evaluate & compare various anterior segment parameters in subtypes of primary angle closure glaucoma (PACG)- acute & chronic, with ultrasound biomicroscopy (UBM) & gonioscopy, before and after Laser Peripheral Iridotomy (LPI).

Material and Methods: A total of 70 eyes of 39 subjects were included in this study, which were divided into two groups, acute PACG and chronic PACG. Above groups included 20 eyes of 12 subjects of acute PACG & 50 eyes of 27 subjects of chronic PACG. Anterior segment parameters measured were: angle opening distance 250μ (AOD250), angle opening distance 500μ (AOD500), trabecular – iris angle (TIA), trabecular–ciliary process distance (TCPD), Iris thickness (IT) 1,2 & 3. INCLUSION CRITERIA: Only newly diagnosed cases of acute & chronic PACG> 20 years of age without LPI were included. EXCLUSION CRITERIA: History of blunt or penetrating trauma in same eye or uveitis. History of any intraocular surgery (cataract, anti-glaucoma surgery etc.),all secondary & pediatric glaucomas.

Result: AOD250, AOD500, TIA and TCPD values significantly increased in post LPI patients based on UBM parameters. On gonioscopy, there was a significant increase in Shaffer angle grades after peripheral iridotomy. Between ultrasound biomicroscopy (UBM) & gonioscopy, UBM is a quantifiable method.

Conclusion: There is a significant opening of the anterior chamber angle after LPI. Early LPI on the basis of UBM findings can prevent progression and complications related with PACG.


Key Words : laser peripheral iridotomy, primary angle closure glaucoma, ultrasound biomicroscopy, gonioscopy, intra ocular pressure.

DOI : http://dx.doi.org/10.7869/djo.2012.81
(Perkin’s), gonioscopy (Goldman two mirror), automated Perimetry (octopus 101) & UBM (OTI scan 2000 model – Ophthalmic Technology incorporation, Toronto, Canada). Patients of acute & chronic PACG who were subjected to LPI and were followed one week later and gonioscopy & UBM were repeated.

**Inclusion Criteria**

All newly diagnosed cases of acute & chronic PACG > 20 years of age, who had not undergone LPI were selected.

**Exclusion Criteria**

History of blunt or penetrating trauma in same eye, Past or present history of uveitis, history of intraocular surgery (cataract, anti-glaucoma surgery etc.), secondary glaucomas, pediatric glaucomas.

**Results**

Among two groups, acute (20 eyes of 12 subjects) & chronic (50 eyes of 27 subjects) primary angle closure glaucoma were diagnosed as per criteria mentioned earlier.

A total of 70 eyes of 39 subjects were included in this study. Table 1 shows gender distribution of PACG. The mean age of 2 groups was: acute PACG 37.75+/−11.36

**TABLE 1 : Gender Distribution**

<table>
<thead>
<tr>
<th>Sex</th>
<th>Acute PACG</th>
<th>Chronic PACG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>47.3%</td>
<td>46%</td>
</tr>
<tr>
<td>Female</td>
<td>52.7%</td>
<td>54%</td>
</tr>
</tbody>
</table>
years, chronic PACG 54.92+/−12.19 years. Out of 20 eyes of acute PACG, right eye was involved in 12 (60%) & left eyes in 8 (40%), while in chronic PACG 27 (54%) were right eyes & 23 (46%) were left eyes. Gonioscopy classification, as per Shaffer’s grading was done. Angles were broadly divided in 2 categories - narrow (Shaffer grade 2 or less) & open (Shaffer grade 3 or 4) and temporal angles of all eyes were studied to maintain uniformity. Out of 20 eyes who presented with acute PACG, 12 (60%) had completely closed angle (grade 0), while 8 (40%) of them had grade 1. Post LPI, only 2 (10%) out of 20 eyes remained closed angle; 9 (45%) eyes had grade 1, while 9 (45%) eyes improved to grade 2. Among grade I post LPI, 2 eyes had grade 1 as of pre LPI. Out of 50 eyes of chronic PACG, 10(20%), 19(38%) & 21(42%) eyes had grades 0,1,2 respectively. Post LPI, there was no eye with completely closed angle and 8(16%), 31(62%), 11(22%) eyes had grade 1, 2 & 3 respectively. Out of grade I post LPI, only 2 eyes had same grade I angle grading as of pre LPI & 7 eyes had no improvement in pre LPI Grade II angle, and remained in grade II post LPI. After LPI, 20 eyes of acute PACG, in only 2 (10%) PI were not patent, similarly in chronic PACG, in 12 (24%) PI were not patent. The mean values of all UBM parameters in both groups with range of one standard deviation, before LPI & one week after LPI, along with comparative significance differences in both groups (P-values) in acute PACG & chronic PACG patients are shown in table 2 & 3 respectively. It shows there is significant improvement in angle opening distance 250μ (AOD250), angle opening distance 500μ (AOD500), trabecular – iris angle (TIA) and trabecular–ciliary process distance (TCPD) seen after LPI in acute PACG than chronic PACG, but iris thickness comparison between two groups show less significant difference in both groups.

**Discussion**

In our study, acute PACG eyes showed significant increase in all anterior segment parameters measured (AOD 250, AOD 500,TIA,TCPD,IT) after LPI and the eyes with chronic PACG showed significant increase in all above listed anterior segment parameters measured excluding iris thickness.

A previous study done by Bhat et al (Personal Communication) found that after LPI, TIA increased from 19.50±5.84 to 28.82±6.71 in superior angle. There was also increase in IT1, IT2, IT3 from 0.30±0.09, 0.30±0.10, 0.60±0.15 to 0.32±0.70, 0.43±0.11, 0.60±0.13 respectively. Another study done by Gazzard et al concluded that in Asian eyes with high risk of developing acute PAC, LPI produced significant widening of the anterior chamber angle without deepening of the anterior chamber centrally. Similarly Kaushik and coworkers concluded that LPI significantly widened the anterior chamber angle in the quadrant with LPI and the quadrant furthest away in patients of chronic PACG with established glaucomatous damage and this change was much better appreciated by UBM than by gonioscopy. On the contrary, in the study carried out by Dada and coworkers at AIIMS, New Delhi, they found
that there was significant increase in width of superior and inferior anterior chamber angle as well as in the TCPD and AOD after LPI in PAC with no significant change in PACG. There is no significant change in any of the anterior segment parameters in eyes with PACG. The main cause for this is the closure of the angle by extensive peripheral anterior synechiae in PACG.

Thus all above studies show that there is widening of the anterior chamber angle following LPI. This change was significant in acute PACG cases only and the changes in anterior segment parameters post LPI in chronic PACG cases was not significant as per the above studies. There are a few limitations to our study. First, the UBM findings may be variable and may be affected by the imaging technique by UBM operator or lighting conditions. As a single person has performed the UBM in all the cases, in similar ambient light conditions, this bias may have been minimal. Second, the analysis of the angle in each quadrant has been based on a cross-sectional image of the angle. The variations in the quadrant, for example, the presence of peripheral anterior synechiae in the scan may not be representative of the remaining angle in the quadrant. As this was a one-time assessment, intra-observer and inter-observer agreement could not be obtained from this study.

Conclusion

1. There is a significant difference in the anterior segment anatomy pre & post LPI. It shows there is a significant opening of the anterior chamber angle post LPI that helps to remove the pupillary block and increase the aqueous outflow in angle closure glaucoma patients.

2. UBM parameters are quantifiable as it provides accurate, non-invasive in vivo imaging of structural details of angle at near microscopic resolution even in opaque media, though gonioscopy is a must.

3. Early diagnosis of angle closure by UBM and subsequent early LPI which opens the angle when applied in proper patients can prevent the consequences of PACG.

References

Transcanalicular Endoscope Combined Laser Assisted Dacryocystorhinostomy

Virendra K Pal MS, Ajai Agarwal MS, Suvarna Suman MS, VB Pratap MS

Abstract

Transcanalicular endoscope combined laser assisted dacryocystorhinostomy (Transcanalicular ECLAD) is a new minimally invasive dacryocystorhinostomy procedure which is performed by diode laser through lacrimal canaliculi with the help of a cannula and fibre optic cable. The interior of nasal cavity is visualized with the help of nasal endoscope. The view of interior of nasal cavity is projected on a monitor with the help of video camera which is incorporated in nasal endoscope. The Transcanalicular ECLAD have various advantages over conventional dacryocystorhinostomy (DCR) and easy to learn without compromising the result.


Key Words : transcanalicular, turbinate, fibre optic cable, diode laser

DOI : http://dx.doi.org/10.7869/djo.2012.82

External or conventional dacryocystorhinostomy (DCR) is the gold standard surgical procedure for the management of nasolacrimal duct obstruction in adult with a high success rate (93-95%). The Italian otolaryngologist A. Toti first described the method of external dacryocystorhinostomy for treating stenosis of the lacrimal sac in 1994 but it is a difficult and time consuming procedure with certain limitations. To overcome these limitations a new technique this is known as Transcanalicular Endoscope Combined Laser Assisted Dacryocystorhinostomy (ECLAD) is described here.

Transcanalicular ECLAD

It is a new, minimally invasive DCR procedure which is performed by diode laser through lacrimal canaliculi with the help of a nasal endoscope. It has advantages of minimal discomfort to patient and is quick and effective (may be performed on OPD basis).Further no incision is required and ligaments and muscles of internal canthus are well preserved. The simplicity of the technique and its excellent aesthetic results has made the technique desirable and popular.

TABLE 1 Technical specifications of ECLAD Machine

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wavelength</td>
<td>980 nm (Infra red)</td>
</tr>
<tr>
<td>Optical power</td>
<td>10 watt (Maximum)</td>
</tr>
<tr>
<td>Aiming beam</td>
<td>635nm, 4mw, brightness adjustable</td>
</tr>
<tr>
<td>Operating mode</td>
<td>Cw pulsed</td>
</tr>
<tr>
<td>Weight</td>
<td>5kg</td>
</tr>
</tbody>
</table>

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Figure 1: ECLAD diode laser with footpedal
The only disadvantage is the cost of machine which is high.

The technical specifications of the machine is described in table-1.

The components of machine includes Eclad diode laser with footpedal (figure 1a & b), Eclad laser fibres 600 micron with 360micron core, ECLAD -DCR introducer (cannula with stelate) (Figure-2) and nasal endoscope with camera with attached monitor (figure 3a & 3b).

**Principle of surgery**

Unlike external DCR, fibre optic cable for laser delivery is introduced in cannula through the lacrimal canaliculi and an opening is created with the help of diode laser through the inner wall of lacrimal sac, lacrimal bone and nasal mucosa by vaporization of soft and hard tissue along with coagulation.

**Method**

The preoperative evaluation includes complete hemogram (Hb, TLC, DLC, BT, and CT), blood glucose estimation and nasal evaluation

**Surgical Technique**

The surgery can be performed in local or general anaesthesia. The lower or upper punctum is dilated with punctum dilator. Probing (starts with lower number 0-0 and increases up to desired level) is done and hard stop is felt. Cannula along with stelate is passed in canaliculi and cannula advanced up to hard stop, stelate is removed and cannula is rotated at 45 degrees. Laser fibre optic cable is introduced into the cannula with aiming beam in on position. Another person holds the nasal endoscope and introduces it in nostril of nose on side to be operated and focusing of area of middle turbinate is done.

Now as the picture of inside of nose is visualised on monitor, aiming beam is localised and positioned between turbinates and nasal septum. If localization is difficult intensity of beam can be increased and blinking light may be used figure-4. As the aiming beam is localised in correct position the ‘ready button’ is pushed on and warm machine and foot pedal is pressed to deliver laser energy simultaneously advancing fibre optics gently (not pushing cannula). Now cutting of bone is felt and as you pierce through and through using laser energy, bony opening is made and the aiming beam with laser probe is visualised on the monitor (Figure-5). Now power is stopped and probe is pulled backward and just move probe with cannula, again focus aiming beam at margin of previous opening and again cut the margin in this way the ostium is enlarged up to the formation of sufficient sized (4-5 mm) opening (avoiding damage to the turbinate and nasal septum) (Figure-6). Syringing is done with normal saline, betadine 5% solution and then with mitomycin-c (0.02%) solution. During syringing we look for flow of solution on monitor. If it is sufficient cannula is removed and a drop of antibiotic-steroid eye drop placed in conjunctival cul-de-sac. No dressing or pad is required.
Post operatively the patient is put on oral antibiotic and NSAID for 5 days, gatifloxacin-steroid eye drop 6-times daily 1.5 month (tapering manner) and xylomatazoline nasal drops for two weeks. Syringing is performed on 2nd, 7th and 30th post operative days.

**Discussion**

In conventional DCR obliterated nasolacrimal duct is bypassed and the lacrimal sac is opened directly into the nasal cavity with the help of lacrimal and nasal mucosal flap after making a ostium in bone but this operation have following limitations like time taking and skilled procedure, bleeding, incision related complications, post surgical scarring and disturbance of medial canthal tendon and muscles. So during modern era when early rehabilitation and cosmetic appearance are great importance, it is the need of time that this surgery also crosses the need of incision without compromising the successes rate.

The first intranasal approach was described in 1889 by Killian, and endoscopic Dacryocystorhinostomy (DCR) was first performed by Caldwell in 1893, but was soon abandoned due to difficult visualization and numerous complications. The endonasal technique has gained popularity only in the past decade due to the developments in endoscopic surgery. It is performed endoscopically through the nose without the need for an external skin incision. The success rate is 70 to 90 %. The first cadaveric study in 1990 proved that osteotomy of lacrimal bone can be achieved by means of laser energy, delivered through an optic fiber by transnasal or endo-canalicular approach. Lasers with several different wavelengths have been used to perform osteotomy as part of the DCR procedure, mostly as part of a transnasal approach: Holmium: Yttrium-Aluminum-Garnet (Ho: YAG) laser, potassium-titanyl-phosphate (KTP) laser, Neodymium: YAG (Nd: YAG) laser, Erbium: YAG (Er: YAG) laser, and diode laser. The use of a diode laser for EL-DCR has been first reported by Eloy et al. in 2000, followed by Fernandez et al. in 2004. Diode laser-assisted DCR seems to offer specific advantages for DCR. The main technical obstacles in EL-DCR are to deliver a sufficiently powerful laser beam via a relatively narrow
optical fiber, which in turn fits into an endocanalicular probe. Several laser wavelengths successfully comply with this requirement. Yet there are other considerations to take into account, mainly unwanted collateral heating of the probe and residual thermal damage to the target tissue. Based on theoretical and our own preclinical studies, the 980 nm diode laser seems to adequately fulfill the entire above requirements. The last step in the development of less traumatic DCR is the endocanalicular/transcanalicular approach. In this approach, first described in 1963 by Jack, a probe is inserted through the lower lacrimal punctum via the canalculus into the lacrimal sac following the anatomical pathway of tear outflow. Osteotomy is performed either by a mechanical drill or laser energy through an optic fiber, which is inserted within the probe. Success in DCR surgery is compromised by a small osteum and blockage due to tissue growth and scarring. The small osteotomy site failure in DCR. An osteotomy of more than 10 mm in the site of osteotomy is one of the leading causes of long-term failure in DCR. One of the main open questions is adequate osteotomy size, as restenosis at the site of osteotomy is one of the leading causes of long-term failure in DCR. An osteotomy of more than 10 mm in diameter can be routinely achieved by the classic approach, and a slightly smaller osteotomy of 7-9 mm is achieved with the transnasal approach. The osteotomy size in our series was on an average 5 mm.

We believe this is sufficient when using our technique, as there is minimal trauma to the surrounding mucosa and connective tissue, resulting in less postoperative scarring. An interesting computed tomography study by Yazici and Yazici showed that final nasal ostium size six months after surgery is in no correlation with osteotomy size at time of surgery and suturing of mucosal flaps, and measured from 3.1 to 3.8 mm in height.

Conclusions

The T-ECLAD is a new contribution to the field of lacrimal surgery. It is a minimally invasive quick procedure; it may be a hope for future with better results if we continuously improve and analyzed the procedure.

References

Delhi Ophthalmological Society

64th DOS Annual Conference
12th to 14th April 2013
Hotel Ashok, Chanakyapuri, New Delhi
Unilateral Orbital Compartment Syndrome with Cavernous Sinus Thrombosis after Prolonged Prone Position Anaesthesia for Spinal Surgery

Mansur Ali Khan MS, Sanjeev Agarwal MS, Sandeep Shankar MS, DNB

Abstract

Orbital compartment syndrome is a rare but preventable cause of blindness. A 42 year old male patient, a case of accidental fracture cervical spine and quadriplegia underwent cervical spine surgery under general anaesthesia. Surgery was performed with patient in prone position on a padded horse shoe stand for 4 hours duration. Proptosis, redness and chemosis of right eye was noticed 3 hours after recovery from general anaesthesia. The affected eye was stony hard with corneal oedema, fixed dilated pupil, total ophthalmoplegia and absent perception of light. Other eye was unaffected. An urgent canthotomy and cantholysis was done and topical as well as systemic antiglaucoma treatment instituted along with systemic and topical antibiotics. A contrast-enhanced computed tomography, done the next day revealed anterior displacement with posterior tenting of right globe and bilateral cavernous sinus thrombosis. Proptosis and swelling subsided gradually without any recovery of vision. Generalised retinal atrophy and secondary optic atrophy was seen 3 weeks post surgery.


Key Words : orbital compartment syndrome, prone position, cavernous sinus thrombosis, cantholysis.

DOI : http://dx.doi.org/10.7869/djo.2012.83

Visual loss after prolonged spinal surgery in prone position is very rare.1 The loss of vision is usually due to ischemic optic neuropathy or central retinal artery occlusion.2 We report a case of loss of vision due to orbital compartment syndrome and cavernous sinus thrombosis following prolonged surgery in prone position, which is extremely uncommon.

Case report

42 year old male patient, a case of C6,7 grade III subluxation with locked facets bilaterally and traumatic cervical cord injury with quadriplegia following road traffic accident, was taken up for cervical spine surgery for reduction of locked facets and fixation of fracture dislocation with interlaminar wiring and bone grafting. Patient was given general anaesthesia (GA) with endotracheal intubation, muscle relaxant and intermittent positive pressure ventilation. He was placed prone with Philadelphia collar with cervical traction onto horse shoe stand. Adequate padding of horse shoe and clearance of eye and maxilla was confirmed, traction continued and collar removed. GA was maintained with N$_2$O/O$_2$ (2:1) + Sevoflurane. Total duration of surgery in prone position was 4 hours, intra operative blood pressure (BP) ranged from a low of 88/58 to high of 110/80 mm of Hg by non-invasive BP monitoring. On the whole BP was stable. Oxygen saturation was maintained between 98 to 100 %. Blood loss was 1000 ml and 2 units of blood were transfused. Recovery from GA was uneventful and spontaneous and

Figure 1: Right eye of patient showing tense swollen lids with chemosis, proptosis and corneal oedema.
Patient shifted to intensive care ward. Post operatively he was given intravenous wymesone (dexamethasone) and antibiotics omnatax (Cefotaxime) and amikacin. No redness or swelling around eyes was noticed or documented at the end of surgery by the surgical team. Proptosis, chemosis and lid swelling of right eye was first noticed 3 hours later by the nursing staff and the treating surgeon asked for ophthalmic consultation. On examination perception of light was absent in right eye. There was proptosis, severe conjunctival chemosis, swollen, tense lids with globe exposure, (Figure 1). The eyeball was stony hard with complete external ophthalmoplegia. There was corneal oedema with dilated fixed pupil. Fundus view was obscured due to corneal haze. The left eye was unaffected. With a clinical diagnosis of orbital compartment syndrome, an urgent canthotomy and cantholysis was done. Simultaneously intravenous mannitol and oral acetazolamide was given. Topical antibiotics and antiglaucoma medications were instituted. Contrast enhanced computerised tomography (CECT) scan of brain and orbits was done which showed tenting and anterior displacement of right globe as well as hypo dense nonfilling of both cavernous sinus suggestive of cavernous sinus thrombosis (Figure 2). Injection Enoxaparin sodium (low molecular weight Heparin) sub cutaneous was added. There was gradual but complete regression of proptosis and chemosis with recovery of ocular movements but no recovery of vision. At 3 weeks post surgery right eye was soft. Pupil remained fixed dilated (Figure 3). Fundus examination revealed an atrophic retina with attenuated vessels and secondary optic atrophy. Since patient remained quadruple and confined to the bed fundus photographs could not be taken.

**Discussion**

Post operative visual loss after non ocular surgery in any position is very rare with a reported incidence of 0.008%. However, a somewhat higher incidence of up to 0.2% has been reported following prone position spinal surgery. The loss of vision is usually due to ischemic optic neuropathy, central retinal artery or vein occlusion and rarely because of cortical blindness. Orbital compartment syndrome (OCS) occurring after prolonged prone position is extremely rare. It was first documented by Hollenhurst and thereafter there have been very few reported cases in recent literature. Orbital compartment syndrome is a rare, ophthalmic emergency, characterised by acute rise in orbital pressure within the confined orbital space, resulting in damage to ocular and other intraorbital structures culminating in blindness, unless detected and treated early. It has been reported to occur following acute orbital haemorrhage, orbital cellulitis, emphysema, inflammation and tumours. Prolonged hypoxemia with capillary leak, intra orbital foreign body, massive fluid resuscitation after burns, and position dependent oedema are the other less common causes.

The postulated mechanism for OCS following prolonged prone position surgery is due to pressure on the affected eye usually by the head rest resulting in partial or complete collapse of the orbital vessels. On release of external pressure the ischemic vessels dilate causing transudation of fluid into the tissue spaces resulting in increased intraorbital tension. Increasing orbital pressure leads to obstruction of venous outflow, reduced central retinal artery flow and decreased optic nerve perfusion causing ischemic insult. When intraorbital tissue pressure exceeds that within the arteries, the flow ceases. The ischemic arterioles eventually become sclerosed and ganglion cell degeneration leads to...
optic atrophy. In this case there was probably inadvertent compression of the affected eye by the padded head rest during the prolonged surgery in prone position. Periods of hypotension and blood loss are the other factors which may have added to the ischemic insult. The patient being a quadriplegic and in a debilitated state did not report any symptoms till it was noticed by the nursing staff resulting in delay in diagnosis and therefore the poor outcome. Tenting of posterior globe, a typical CT finding of OCS was seen in this case as well, along with hypo dense filling defect of both cavernous sinuses suggestive of thrombosis. There is only one report of cavernous sinus thrombosis associated with orbital compartment syndrome on the same side after prolonged prone position surgery, reported as a delayed presentation seen after two weeks. Surprisingly no clinical manifestation was seen in the other eye, despite evidence of bilateral cavernous sinus thrombosis on CECT. Probably the primary thrombus was on the affected side with extension contralaterally. Prompt institution of anticoagulants helped in resolution of the thrombus before it could cause complete blockage and produce visible signs. Further confirmative tests such as digital subtraction angiography or 3 dimensional CT angiogram was not done as there was clinical response to the treatment and therefore subjecting the patient, who was already in a debilitated state, to further investigations, was not clinically indicated. Ensuring clearance of the eyes from the head rest and any other supporting structure at all times during surgery is vital to prevent this rare but devastating complication. For this, interim checks of the eyes during surgery may be indicated. Surgeons need to be aware of this condition so as to counsel the patients to report any blurring of vision following surgery and to monitor the patient to detect early ocular signs.

References

Unusual Case Report of Flat, Sharp and Pointed Metallic Foreign Body Traversing the Orbital Floor

Manish Sharma MS, Chandan Kalla MS, Kishore Kumar MS

Abstract

Loss of vision in conjunction with intraorbital foreign bodies is largely a result of the initial trauma. We aim to report an unusual orbital injury in which a flat, sharp and pointed metallic foreign body (Blade of scissors around 8 cm in length) traversed within the periosteum of orbital floor diagonally entering at its anterio-medial aspect and going posteriorly & laterally up to inferior margin of lateral orbital wall. CT scan showed that there was no ocular damage and extra ocular muscles & optic nerve were also not injured. Management strategy is discussed in the report. Ocular movements were normal postoperatively and patient had a final visual outcome of 6/6.

Key Words: orbital floor, metallic foreign body, intra orbital foreign body
DOI: http://dx.doi.org/10.7869/djo.2012.84

Large orbital foreign bodies (FB) are usually associated with high-velocity injuries. They are often associated with orbital wall fractures. A related net search will reveal a plethora of such cases. Our case assumes distinctness as cases of very large metallic foreign body traversing through orbital floor are relatively rare. Secondly, intraorbital FBs are often associated with sight-threatening complications. A retained metallic intraorbital FB may also cause a variety of signs, symptoms, and clinical findings, based on its size, location, and composition. In our case, the damage to orbital contents was minimal.

Case report

A 23-year old male presented to our emergency with a history of assault by scissors on right side of face (Figure 1). On examination, a metallic foreign body was seen protruding from a lacerated entry wound just below the right lower lid near medial canthus.

X-ray of orbit AP and lateral view was performed which revealed a large pointed metallic foreign body along the orbital floor that was going towards inferior margin of the lateral wall. To know about further extent of injury and to plan surgical management, 3 Dimensional computerized tomography was done. To our shocking delight, the foreign body (blade of scissors) was subperiostal (beneath the periosteum of the bony orbital floor) and the globe, extra ocular muscles and optic nerve were intact. The foreign body had entered the orbital floor subperiostally and after coursing across the orbital floor, it was also piercing zygomatic bone (Figure 2).

After an informed consent, the patient was taken for operation under general anaesthesia. The part of metallic foreign body that was protruding out of entry wound was grasped with the help of surgical pliers. We found that the foreign body was firmly impacted within the bony orbital floor and; it was not mobilized at all. On gentle pulling after

Figure 1: Penetrating orbital injury with metallic scissors
again reviewing the CT scan and consulting the maxillofacial surgeon, it was decided that stronger pulling force is needed to be applied in the same trajectory (direction) in which the metallic foreign body had entered. The foreign body was firmly grasped with surgical pliers and pulled strongly by the operating surgeon while patient’s head was stabilized by the assisting surgeon.

Initially foreign body could be moved only slightly but on applying a greater force, the foreign body was finally removed. A sudden gush of blood was observed from the entry wound, which was managed by applying pressure. The entry wound was sutured in two layers using 6-0 vicryl and 5-0 silk sutures (Figure 3). A post operative ocular examination showed normal anterior and posterior segments. Ocular movements were free & full and visual acuity was 6/6 (Figure 5). A post operative CT scan revealed that the globe, extraocular muscles and optic nerve were intact. However, the inferior margin of lateral wall of orbit (zygomatic bone) was fractured.

**Discussion**

Intraorbital foreign bodies are usually associated with severe injuries that may lead to sight threatening complications. A retained metallic foreign body causes a variety of clinical features, based on site of location. Loss of vision is usually a feature of intraocular trauma. The removal of foreign body from orbit which is crowded with delicate structures is also not safe. The decision regarding
surgical removal depends mainly on the location and the type of intraorbital foreign body.\textsuperscript{3}

The floor of orbit is mainly formed by the orbital plate of maxilla which articulate with the zygomatic bone anterior laterally and the small triangular orbital process of Palatine bone posteriomedially. The floor is thin and forms roof of maxillary sinus.\textsuperscript{5} In our patient, the size of foreign body was amazingly large (8 cm) (Figure 4) but its location was unique in that it was beneath the periosteum of orbital floor.

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**References**


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**Figure 5:** Patient 3 month after injury
Acute Solar Retinopathy

Shikha Baisakhya DOMS, Mridu Chaudhry MS, Prafulla Manjhi MD, Meenu Babber MS, Chandan Mehta

Abstract

Solar observation and eye damage is known for centuries. Unprotected eclipse viewing is the leading cause of solar retinopathy. Inspite of using commercially available certified solar filters, use of binoculars, exposed photographic film and X-ray film are common unsafe practice of eclipse viewing. Public awareness by media campaigns about the appropriate protective measures while viewing an eclipse is the mainstay in the prevention of this disease. The natural course of solar retinopathy is to show resolution and visual improvement, but use of anti-inflammatory drugs hastens the recovery. We report a case of young male with acute solar retinopathy after viewing solar eclipse. The patient was successfully treated with corticosteroids with complete visual rehabilitation.

Key Words : solar retinopathy, eclipse burn, foveomacular retinitis
DOI : http://dx.doi.org/10.7869/djo.2012.85

Solar retinopathy is retinal damage caused by direct or indirect viewing of the sun. The clinical condition is also known as foveomacular retinitis, eclipse retinopathy, solar retinitis, eclipse blindness, eclipse burn and solar chorioretinal burn. Ocular damage due to solar observation is well known since centuries. Galileo the famous scientist injured his eyes by solar observation through the telescope. Solar eclipse is a geophysical event that occurs when the moon appears between sun and earth. Unprotected eclipse viewing is the commonest cause of solar retinopathy. Other people at risk include sailors, sun bathers, photographers, religious fanatics and people under the influence of hallucinogenic drugs like LSD. Sunglasses, binoculars, exposed photographic film or X-ray film are common unsafe practices of eclipse viewing. Commercially available certified solar filters are the only safe method for eclipse observation. Most of the harmful electromagnetic radiations present in the sunlight are filtered out by the atmosphere. Still the sunlight that reaches the earth contains sufficient amount of ultraviolet radiation to cause damage to the biological tissue. The severity of retinal lesion and visual loss depends on duration of exposure. However, retinal lesions with very short exposure to the sun are also reported in the literature. People who have undergone cataract surgery, with retinal dystrophy or albinism are at increased risk of developing solar retinopathy. Patients using photosensitizing drugs like tetracycline and psoralen are at increased risk of retinal damage. Most cases of solar retinopathy improve over time without treatment. Although there is no standard protocol for the treatment of the condition, corticosteroids and antioxidants are found to be beneficial. In this article we report a case of young male with acute solar retinopathy after viewing solar eclipse. The patient was successfully treated with corticosteroids with complete visual rehabilitation within one month.

Case report

A 21 year old male presented to the eye out patient department (OPD) with complaints of blurring of vision, central scotoma and metamorphopsia since one day after watching the solar eclipse through the radiographic film. The duration of exposure was 2 to 3 minutes. Patient was not predisposed to solar retinopathy by any known risk factor in form of systemic or topical medications or ocular and systemic diseases. On examination the visual acuity was 6/60 in both the eyes. The anterior segment was within normal limits on slit lamp examination. Amsler grid revealed central scotoma and metamorphopsia. Intraocular pressure (IOP) measured with Goldman applanation tonometer was 12 mm of Hg in both eyes. Fundus examination with indirect ophthalmoscope showed a small yellowish gray lesion in the centre of foveolar area. The fundus picture was symmetrical in both the eyes. Based on the history and fundus findings the diagnosis of bilateral acute solar retinopathy was made. Fluorescein angiographic findings were normal. Patient was treated with oral prednisolone tablets in dose of 1mg/kg of body weight for 1 week, which was then gradually reduced over a period of four weeks. Patient was relieved of the symptoms of metamorphopsia and central scotoma in one week. The visual acuity improved to 6/6 over a period of one month with no residual damage to the macula. We decided to treat the patient with steroids instead of waiting...
Discussion

Eclipse blindness is the retinopathy caused by direct or indirect viewing of the sun. The extent of retinal damage is dependent upon the intensity and duration of solar exposure. Solar observation more than 90 seconds exceeds threshold of retinal damage. There is a variation in individual susceptibility to solar retinopathy. Patients with pseudophakia, aphakia, retinal dystrophy and on photosensitizing drugs like tetracycline are at increased risk of developing solar retinopathy. The pathophysiology of solar eclipse retinopathy is due to retinal damage. Electromagnetic radiations emanating from the sun in the non-visible band have a serious impact on biological functions. Sunlight that reaches the earth contains sufficient amount of harmful ultra violet rays to cause ocular damage. The sun casts image of 160 μ diameter on the retina. The temperature rise is directly proportional to extent of macular damage. With 3mm pupillary diameter there is 4 °C rise in temperature whereas 22 °C rise in temperature occurs with 7 mm pupil. During solar eclipse there is dilatation of the pupil so brief exposure during a solar eclipse is potentially dangerous for vision. Short intense exposure to sunlight particularly with dilated pupil for more than 90 seconds causes photochemical damage to photo-receptors. Light can damage the retina by thermo-acoustic means. Similar damage could be caused by ophthalmic instruments like operating microscope.

The common presenting symptoms of solar retinopathy include decreased visual acuity, metamorphopsia, micropsia, photophobia, after image, scotoma, and headache. The classical presentation of eclipse retinopathy is a small foveolar lesion yellow white in colour. The lesion fades over a period of 2–4 weeks and is replaced by a depression or partial thickness hole. Lee et al reported a case acute central serous chorioretinopathy (CSCR) after direct solar viewing as a rare presentation of solar retinopathy. Fluorescein angiography is usually normal in the early and late stages of the disease. Sometimes small window defect corresponding to the lamellar hole may be present. Atmaca et al reported normal fluorescein angiographic findings in all the patients of solar retinopathy and evaluated it as a non-conclusive test for this condition. Dhir et al reported microleaks and masking of choroidal fluorescence in early fluorescein angiography of severe cases. The treatment of solar retinopathy is controversial. Most cases of solar retinopathy improve over time without treatment. Corticosteroids prove to be beneficial in the treatment of solar retinopathy because of their ability to suppress inflammatory tissue reactions after injury as in our case. Antioxidants and free radical scavenger gingko glycosides may also be used in mild cases to ameliorate retinal damage. Early presentation and advent of therapy leads to excellent visual recovery. Patients presenting after two weeks or later have poor prognosis. Public awareness about the appropriate protective measures while viewing...
an eclipse and education related to hazards of direct gazing is the mainstay in the prevention of this disease. The natural course of solar retinopathy is to show resolution and visual improvement, but use of anti-inflammatory drugs leads to faster recovery.

References

Spontaneous Resolution of Traumatic Macular Hole in a Child

Lalit Verma MD, Arindam Chakravarti MS, Avnindra Gupta MS, Smriti Prakash B.Opt

Abstract

There are several published reports on spontaneous closure of idiopathic macular hole but information regarding spontaneous closure of traumatic macular hole is limited. We present a case of spontaneous resolution of post traumatic macular hole in a 9 year old child with associated visual recovery. The child was followed up for seven months and the morphological changes were documented on optical coherence tomography. The case study illustrates the role of conservative management of traumatic macular hole in selected young patients, thus preventing the need for surgical intervention and its possible difficulties and complications.


Key Words: macular hole, traumatic macular hole, spontaneous hole closure

DOI: http://dx.doi.org/10.7869/djo.2012.86

Traumatic macular holes are not associated with gradual onset and the mechanism of their formation remains controversial. According to some authors, the force of the impact transmitted to the macula could result in rupture of the fovea.1 Others hypothesise that the cause may be sudden separation of the posterior vitreous, however many patients present with no posterior vitreous detachment.1,2 The advent of optical coherence tomography helped in the detection of subclinical inner retinal layer defects which may play a role in the pathogenesis of traumatic macular hole.3 There are several published reports on spontaneous closure of idiopathic macular hole but information regarding spontaneous closure of traumatic macular hole is limited.4 We present a case of spontaneous resolution of post traumatic macular hole in a 9 year old child with associated visual recovery.

Case History

A 9 year old girl presented with decreased vision in the right eye following blunt trauma. On examination, she had best corrected visual acuity (BCVA) of 20/120 in the right eye and 20/20 in the left eye. Anterior segment was...
within normal limits in both eyes and intra-ocular pressure by non contact tonometry was within normal range in both eyes. Fundus examination of the right eye showed healthy disc, presence of a macular hole with choroidal rupture temporally along with a patch of subretinal haemorrhage around and just temporal to the fovea with vitreous haemorrhage inferiorly; retina was attached. There was no evidence of retinal dialysis. (Figure 1) The fundus in the left eye was within normal limits. Spectral domain optical coherence tomography (Optovue 3 D OCT) showed a near full thickness macular hole with significant loss of tissue in outer retinal layers (Figure 2). Subretinal hyper-reflectivity was noted with mild backshadowing temporal to the fovea due to subretinal haemorrhage. The child’s parents decided to defer surgical intervention to a later date after her academic examinations. The child was followed up over a period of 7 months. Her BCVA and intra-ocular pressure was measured on each visit along with serial colour fundus photos and spectral domain OCT. She presented with a gradual improvement in her BCVA with spontaneous resolution of the macular hole accompanied with resolution of the subretinal haemorrhage. At follow up visit after 2 months, BCVA in the right eye had improved to 20/80 and fundus evaluation showed gradual resorption of the subretinal haemorrhage. The macular hole had reduced in size (Figure 3). After 4 months of follow up, BCVA in the
right eye had improved further to 20/40, fundus evaluation showed further resorption of the subretinal haemorrhage. The macular hole appeared to have significantly reduced in size (Figure 4). At seven months after the injury, the child presented with a best corrected visual acuity of 20/30 in the right eye. Fundus examination showed resolved macular hole with RPE defects near the fovea, choroidal rupture, resolved subretinal haemorrhage and mostly resolved inferior vitreous haemorrhage with attached retina (Figure 5). Spectral domain OCT (Optovue 3D OCT) demonstrated closed macular hole with mild foveal thinning and irregularity of retinal pigment epithelium (RPE –CC) complex temporal to fovea over the area of choroidal rupture. (Figure 6)

**Discussion**

The mechanism of spontaneous closure of traumatic macular hole remains unclear. However tissue proliferation possibly by glial cells or RPE cells may play a role because cell proliferation is likely to be vigorous in young patients. This is supported by studies by Guyer et al in which 3 idiopathic macular holes closed spontaneously by RPE or glial cell proliferation. In idiopathic macular hole, Takahashi et al used OCT to document spontaneous hole closure. The process started as an inward protrusion of tissue around the margins of the macular hole. After that, the protruding tissue connected to bridge the hole and the subretinal space gradually decreased. In idiopathic macular hole, a report concerning the natural course indicated that spontaneous closure occurred in 5% of 66 eyes. Parmar et al has documented OCT evidence of spontaneous closure of traumatic macular hole.

In studies by Mitamura et al, traumatic macular hole resolved in 64% of 11 eyes. Menchini et al also described spontaneous closure of traumatic macular hole. This indicates that the incidence of spontaneous hole closure may be much higher in traumatic cases than idiopathic cases. Factors which may be associated with spontaneous closure of traumatic macular hole are young age, small size of macular hole and absence of posterior vitreous detachment. Pars plana vitrectomy with posterior vitreous detachment (PVD) induction and internal limiting membrane (ILM) peeling remains a common consideration in the management of traumatic macular hole. However, it is important to recognise that small traumatic macular hole in young patients may resolve spontaneously more frequently than idiopathic macular hole. Thus conservative management plays an important role in such cases as it is difficult to induce posterior vitreous detachment and perform internal limiting membrane peeling in young patients. In addition, the attendant surgical problems like creation of iatrogenic breaks, retinal detachment, vitreous haemorrhage and cataractogenesis are avoided. Subsequent cataract surgery inevitably leads to loss of accommodation. However in the scenario of non improvement, surgical intervention is warranted.

**References**

Unilateral Optic Neuritis Associated with Dengue Fever

VK Mohindra1 MNAMS, Anju Kumari2 MS

Abstract

Dengue fever is rarely known to be associated with ophthalmic manifestations involving the posterior segment with an array of hemorrhagic and immune mediated inflammatory sequelae. Optic neuropathy is extremely rare and is usually bilateral. We report a case of unilateral Optic Neuritis in a case of Dengue fever in which the vision could be restored with pulse steroid therapy

Key Words : dengue, optic neuritis, vision loss
DOI : http://dx.doi.org/10.7869/djo.2012.87

Dengue fever (DF) and dengue hemorrhagic fever (DHF) are emerging diseases that are endemic in the tropical and subtropical regions of the world. The disease is caused by four serotypes of dengue virus of the genus Flavivirus transmitted generally by Aedes aegypti. Dengue is not typically associated with ocular complications. The ophthalmic manifestations reported in the literature include conjunctival congestion, subconjunctival hemorrhage, retinal hemorrhages, macular edema, cotton wool spots, serous detachment, retinal vasculitis and retinal pigment epithelium (RPE) disturbances. We report a case of unilateral optic neuritis secondary to dengue fever.

Case Report

A 34 year old lady was admitted for intermittent high grade fever, myalgia and arthralgia of two weeks duration with dull aching ocular pain and diminution of vision in right eye for one day. On examination she had visual acuity of counting fingers close to face with accurate projection of rays in right eye and 6/6 in left eye. Pupillary examination revealed relative afferent papillary defect (RAPD) on the right side. Rest of the anterior segment examination was unremarkable in both eyes. Fundus examination of the right eye showed an elevated optic disc with hyperemia, obliterated cup, venous engorgement and peripapillary edema (Figure 1). The left eye fundus was WNL. Investigations established the diagnosis of dengue fever (a positive IgM antibody titre). Rest of the hematological and serological investigations including platelet count with in normal limit. A diagnosis of optic neuritis secondary to dengue fever was established and the patient was started on intravenous methyl Prednisolone 250mg 6 hourly for

3 days followed by oral Prednisolone 60mg/day for 11 days and tapered over 3 days along with broad spectrum antibiotic cover in consultation with the neurophysician. On discharge her vision improved to 6/9 with complete resolution of optic disc edema.

Discussion

Dengue infection is caused by the dengue virus, of which there are four closely-related but antigenically distinct serotypes that do not confer cross-immunity: DEN 1,2,3 and 4. As such, individuals in endemic countries are not protected from the other serotypes after infection with one serotype. DHF is defined by the World Health Organization

Figure 1: Optic disc hyperemia with edema and obliteration of cup of right eye

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as dengue fever associated with thrombocytopenia (< 100 ×10^9 cells/L) and haemoconcentration (haematocrit > 20% above baseline). DHF rarely has ocular manifestations but there has been increased reports in recent literature. The onset of visual symptoms closely correlated with the nadir of thrombocytopenia associated with DF. The pathogenesis for ophthalmic complications in dengue fever is unclear. The most common ophthalmic complications include subconjunctival hemorrhage secondary to a bleeding diathesis and nonspecific orbital pain. The most common ocular manifestation in immunocompetent individuals is an inflammatory maculopathy comprising of focal chorioretinitis with or without macular edema and retinal blot hemorrhages.

The associated thrombocytopenia may predispose to hemorrhage. Infection of cells with dengue virus has been postulated to cause a shift in balance of the cell-mediated immunity from TH1 and TH2 resulting in CD4/CD8 inversion and release of proinflammatory mediators including interferon (IFN)γ and tumour necrosis factor (TNF)-α that can directly affect vascular endothelial cell apoptosis resulting in increased permeability. Autoantibodies against endothelial cells and platelets as a result of increased interleukin (IL)-6 production or molecular mimicry against dengue virus structural proteins have also been reported. Other postulates include viral mutations, viral virulence and host susceptibility. Increased vascular permeability due to immune mediated cytokine release can account for macular edema. During dengue viraemia, the immune mediated injury to the vessel wall due to immune complex deposition may lead to vasculitis. Dengue viraemia may be the triggering factor for immune complex formation in patients who are predisposed to developing autoimmune disease. Onset of visual impairment usually coincides with the nadir of thrombocytopenia. Ophthalmic manifestations may include macular edema, retinal hemorrhages, cotton wool spots, retinal vasculitis, exudative retinal detachment and anterior uveitis.

Optic neuritis associated with dengue fever is very rare and in literature the cases reported have been minimal. Optic neuritis has been usually bilateral with dengue fever but in our case the patient presented with unilateral optic neuritis. Inflammatory changes in the vascular endothelium resulting in vascular leakage, hemorrhage and ischemia can be seen in the cells infected with the dengue virus. The cause for the optic neuropathy has been unknown. There is evidence of optic neuritis being immunogenic in origin and therefore the treatment with steroids is justified. However, the clinical systemic condition has to be considered as it is to be used with caution in acute viremia. Visual recovery, in the form of improvement of signs and symptoms, usually corresponds to improving platelet levels but may take several weeks to reach a steady state. In reported cases in the literature, the visual recovery varies from complete improvement to permanent visual loss but in our case the patient improved with the steroid therapy with antibiotic cover to 6/9.

To conclude, optic neuritis can occur in association with Dengue Fever. As the likely pathogenesis is immunogenic, treatment with pulse steroids should be useful in reversing the clinical condition and restoring vision in these patients.

References

Interferons in Ophthalmology
Current Status and Advancing Trends

Shiva Prasad Gantyala MD, Himanshu Shekhar MD,
M.Vanathi MD, Rajesh Sinha MD, DNB, FRCS, Jeewan Singh Titiyal MD

Abstract

Interferon, a natural multifunctional protein, has been an important part of medical therapy in various ophthalmic indications. Interferons are classified as alpha, beta and gamma interferons based on molecular structure and grouped into types 1 and 2 depending on their cellular effects. Its various actions include antiviral, antiproliferative, immunomodulatory and antiangiogenic effects. Its versatile actions makes it an option for treatment in various ophthalmic indications.

Types and Mechanism of action

IFN are a diverse family of pleotropic cytokines that play an important role in innate immunity. They are characterized by their ability to inhibit viral replication, reduce cell proliferation, immunomodulatory and antiangiogenic activity. They are involved in defence against viral infections, tumor growth, and tolerance induction as suspected inducers of autoimmune disease. Its versatile actions makes it an option for treatment in various ophthalmic indications.

Role of IFNs in Ophthalmology

IFNs are indicated in ophthalmology based on its antiproliferative, immunomodulatory and antiangiogenic properties. Its use in ophthalmology was started initially for ocular surface neoplasia but its advantage has been extended for use in refractory uveitic cystoid macular edema (CME) and exudative age-related macular degeneration (AMD).

Local use as

1. Antineoplastic in Ocular Neoplasia

Ocular Surface Squamous Neoplasia (OSSN): The standard treatment of OSSN is surgical excision with adjunctive cryotherapy. Risk of recurrent disease has been reported in a few cases where medical therapy in the form IFNs has become a valid option. Usually topical and subconjunctival injections of INF-α2b have been used to treat OSSN. The standard regimen for topical use is 1 million IU/ml four times a day for 4 weeks and is equally effective as of 3 million units. Topical therapy eliminated the disease in 81 % of eyes with conjunctival intraepithelial neoplasia (CIN) and recurrence was in 10 % at 3 months. Perilesional along with topical INF α2b for 6 weeks had complete clinical resolution of conjunctival and corneal intraepithelial with no treatment
failures and recurrences in a series of six patients.

**Melanoma**: Topical INF α2b (1 million units/ml) for 3 months has been shown beneficial role in treating conjunctival melanoma. Further studies are required to assess the longterm safety for its valid use for treating melanoma.

**Conjunctival Mucosa-associated lymphoma (Conjunctival MALToma)**: Role of IFNs in conjunctal MALToma is based on its immunomodulatory effect. Intralesional injection of 1,500,000 IU of INF α2b 3 times weekly for 4 weeks has shown a complete response in 75% after the first cycle treatment. Recurrences was seen only in 15% of cases at 5 years follow-up.

**Squamous Papilloma**: Conjunctival squamous papilloma is a benign tumor composed of fibrovascular core surrounded by anacanthotic squamous epithelium and usually strongly associated with human papilloma virus infection. Surgical excision of lesions with adjuvant cryotherapy, CO2 laser and mitomycin-C is the usual described treatment. INF alpha 2b due to its antiviral, antiproliferative and antiangiogenic properties showed successful treatment of conjunctival and recurrent lacrimal papilloma.

2. **Anti-infective and Anti-inflammatory**

**Viral Keratitis**: The standard treatment of herpes simplex keratitis is simple debridement with antiviral agents most commonly acyclovir. However, there has been emergence of antiviral resistant strains in immunocompromised patients who were on chronic acyclovir therapy. Topical INF α2a appears to be an effective treatment adjunct for refractory herpes simplex keratitis in these patients.

**Mooren’s Ulcer**: Mooren’s ulcer is a progressive painful ulcerative keratitis probably resulting from autoimmunity. Beneficial role of topical INF α2a in treating of mooren’s ulcer has been reported although they are indicated as second line of drugs after steroids.

**Vernal Keratoconjunctivitis (VKC)**: VKC is common allergic eye disease affecting young boys in first decade. Usual treatment involves avoidance of allergen, topical antihistaminic, steroids and lubricants. Topical INF α2b has become useful alternative for treating refractory VKC although with short term benefits.

3. **Antifibrotic**

Bleb scarring has been common post-operative complication following trabeculectomy. Slit-lamp needle revision combined with subconjunctival injection of INF α2b, which acts by inhibiting tenon’s capsule fibroblasts, may be helpful in the inhibiting subconjunctival fibrosis.

**Systemic Use**

- **Behcet’s disease**: Behcet’s disease is a multisystem vasculitis with ocular involvement as posterior uveitis and retinal vasculitis, leads to blindness in 20-50% of the involved eyes within 5 years. Human recombinant INF α2a administered at a dose of 6 million units subcutaneously, is effective in ocular behcet’s disease. Improvement in best corrected visual acuity and uveitis score has been noted in 92% of patients.

- **Macular Edema**: INF α2 has been reported to be useful in treating resistant chronic pseudophakic CME and refractory CME secondary to uveitis. This advantage of INF α-2 in CME is due to its ability to enhance the barrier function of endothelial cells. Patients with chronic Irvine-Gass syndrome who have not responded to steroids were treated with 3 million IU of INF α-2a subcutaneously has shown improvement in best corrected visual acuity (BCVA). Systemic INF α-2b is an effective option to treat uveitic CME resistant to immunosuppressants.

- **Antiangiogenic in AMD**: Laser treatment of subfoveal neovascular membrane, due to AMD, has been proven to be beneficial with regard to long-term contrast sensitivity and central scotoma size but was associated with significant visual loss. Dr W. Fung who first described the role of INF α-2b in these patients due their anti-vascular endothelial growth factor (VEGF) activity. Further studies need to assess its safety and long-term efficacy.

- **Multiple Sclerosis (MS)**: IFN-1a has been shown to have beneficial effects in patients with multiple sclerosis with or without optic neuritis. The approach to treating patients with optic neuritis has been modified by the results of the Controlled High-Risk Subjects Avonex Multiple Sclerosis Prevention Study (CHAMPS). Patients with initial episodes of demyelination and subclinical lesions of MS on MRI when treated with weekly intramuscular injections of 30 μgms of INF b1a showed a 50% reduction in progression to clinically definite MS. INF are also beneficial in uveitis associated with multiple sclerosis that was refractory to corticosteroid treatment.

**Side Effects**

The most common side effect of type I IFNs injection site reactions and flu-like symptoms (fever, headache, myalgia, arthralgia, sweating and fatigue). Non steroidal anti inflammatory drugs (NSAID) are treatment of choice for acute side-effects associated with IFNs.

Depression and suicidal intentions can occur during therapy with IFNs independent of pre-existing psychiatric illness. An asymptomatic increase in liver enzymes and a decrease in leucocyte count are seen in as many as 10% of patients. Most of the side effects are mild and reversible.

Ophthalmic side-effects are rare (<1%) but can cause significant vision loss due to involvement of posterior pole or optic nerve. The incidence of retinopathy associated with IFN treatment varies in literature from 18-86%. Hypertension and diabetes mellitus have been shown to...
be risk factors in the development or progression of IFN associated retinopathy.\textsuperscript{24} The most common lesions are cotton wool spots and retinal hemorrhages. Ischemic optic neuropathy is another rare but threatening complication of systemic IFN therapy.\textsuperscript{26} Treatment involves discontinuation of IFNs, proper hydration and prevention of supine hypotension.

**Conclusion**

IFNs are naturally occuring proteins characterised by their antiviral, antiproliferative and antiangiogenic properties. Its versatile actions makes it a useful drug for many ophthalmic conditons. Although the risk of side-effects are less with IFN, posterior segment pathology is excluded especially when it is indicated systemically.

**References**


A Cost Analysis Study of Squint Surgery in A Tertiary Care Ophthalmic Hospital for Development of Users Charges

Sanju Singh MD, Rajesh Sinha MD, DNB, FRCS

Abstract

Ten cases of Squint Surgery were studied to find actual cost incurred on patient care, so as to workout the modalities to develop package system for Squint Surgery. The cost analysis for the package had been divided into ‘primary cost’ in which cost of manpower, cost of consumable, cost of linen and laundering, cost of central sterile supply department (CSSD) and manifold was included. In “overhead cost”, building cost, cost of other fixed assets, electricity and water consumption, sanitation and air conditioning was included to find total cost for deriving the package cost.

Key Words : cost analysis, squint surgery, tertiary care centre
DOI http://dx.doi.org/10.7869/djo.2012.89

The rising cost of the health and hospital care is due to application of newer technology in medical sciences and increased requirement to import technology, equipment and drugs for providing state of art treatment has become a matter of great concern all over the world. It has become mandatory to be cost conscious and to be assertive of the cost benefits. Cost reduction is needed to be effected without affecting the quality and effectiveness of the service. In the recent years there has been great liberalization in economic and trade practices. The impact of such liberalization and globalization has permeated into the health and medical care delivery system resulting in import of high tech equipment and advanced medical practices, leading to further escalation in the cost of medical care.

The health care financing administration (HCFA) has published and laid down specific user charges, be it diagnostic/therapeutic purpose or for hospitalization. To meet the objective of reducing various types of inequities and imbalances – inter regional, rural – urban and between economic classes, NHP-2002 sets out on increased allocation of 55% of the total public health investment for the primary health sector; the secondary and tertiary health sectors being allotted 35% and 10% respectively.1,2 This, therefore, further reduces the availability of funds in governmental tertiary health care organizations, thus necessitating the application of other fiscal measures including introduction of user charges of tertiary health care organizations as a mean to sustain themselves.

Methodology

The following study has been conducted with the method of Activity Based Costing (ABC). It is an essential part of the functional process, improvement and reengineering effort, as it allows managers to create shareholder value through cost structure improvement. It captures quantified cost and time data and translates this into decision information. ABC measures process and activity performance, determines the cost of business process outputs and identifies opportunities to improve process efficiency and effectiveness.

Activity Based Costing (ABC)

Activity Based Costing (ABC) is an accounting technique that allows an organization to determine the actual cost associated with each produce and service produced by the organization without regard to the organizational structure.3,4 ABC methods enable managers to cost out measurements to business simplification and process improvement. ABC is a management tool as well as a financial tool. This method is suited to costing in hospital
because by design, ABC provides not only relatively accurate cost data, but also information about the origin of the cost.

1. **Identification of common ophthalmologic procedures:** From review of medical records from January 2001 to December 2003 it was seen that out of total 61200 surgeries performed, Squint surgeries constituted almost 10% of the total with average growth rate of 20%. Thus this surgical procedure was chosen for the study.

2. **Cost of consumable used in Squint surgeries:** In order to identify the quantum of different consumable required for this procedure, a test study was conducted covering this procedure. The details of different consumable used in the procedure were ascertained from the scrub nurse and this was corroborated by actual observance of this procedure in the operation theatre (OT) and use of consumables by different surgeons. Detailed discussions were held with the concerned resident doctors and operation theater nurses and the consultants so as to establish the quantum of the items used in this process. Then the weighted average cost of different consumables used for all these surgical procedures was ascertained from records of stores and wholesale prices list of different authorized distributors of these items.

3. **Costing of OT per procedure:** This was calculated by apportionment. This included the following:
   (a) Fixed assets: (i) Building Cost
   (ii) Maintenance cost
   (b) Machinery Equipment cost
   (c) Manpower cost
   (d) Electricity cost
   (e) Air Conditioning cost
   (f) Lines & Laundry Services cost
   (g) CSSD & Ethylene Oxide (ETO) sterilization cost
   (h) Water cost
   (i) Cost of Medical Gases

4. **Time for selected procedure:** Average operation theatre table time spent for this procedure was ascertained by observing this procedure at different times by different surgeons and then average time required for this procedure by an average surgeon was ascertained. The OT table time for this procedure was taken from the moment OT table is assigned for that procedure, to the moment when this table is ready for the next procedure.

**Total Cost Per Procedure**

Cost of operation theatre (OT) time per hour × Time for selected procedure + consumables for that procedure.

**Observation**

The costing of identified ophthalmic procedure was done as under:

**Step-I:** Cost of conducting Squint Surgery in OT: Common ophthalmologic procedure was identified from the records of last three years (i.e. January 2001 to December 2003). The procedure was chosen on the basis of total number of procedures per month. The 5 most frequent surgeries procedures being performed at Dr. R.P. Centre are as below (Table 1).

**TABLE 1: 5 Most Frequent Surgical Procedures**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Procedure</th>
<th>No. of Procedure per Annum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Glaucoma Surgery</td>
<td>362</td>
</tr>
<tr>
<td>2</td>
<td>Retina Detachment Surgery</td>
<td>582</td>
</tr>
<tr>
<td>3</td>
<td>Squint Surgery</td>
<td>700</td>
</tr>
<tr>
<td>4</td>
<td>Vitero-Retinal Surgery</td>
<td>1790</td>
</tr>
<tr>
<td>5</td>
<td>Phaco Emulsification &amp; IOL</td>
<td>6782</td>
</tr>
</tbody>
</table>

In this study, costing of Squint Surgery has been done. In this surgery specific consumables is used and its cost varies depending on type chosen. With this in view, cost of most commonly used consumables has been computed separately and total cost of this surgery using different specific consumables has been calculated. Ten cases in each of these identified procedures were followed for the purpose of this study. Calculation of the cost has been done as:

**Step II (A):** Cost of other consumables / case: This has been calculated by dividing the total number of procedures done over the same period by the total number of procedures done over the same period.

**TABLE 2: Cost of Special Consumables Required in RPC OT for Squint Surgery**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Item</th>
<th>Qty. Unit</th>
<th>Cost/Unit</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inj Adrenaline 1:2 Lakh</td>
<td>1</td>
<td>21.00</td>
<td>21.00</td>
</tr>
<tr>
<td></td>
<td>Inj Xylocaine</td>
<td>1</td>
<td>17.00</td>
<td>17.00</td>
</tr>
<tr>
<td>2</td>
<td>Syringe (G/MI)</td>
<td>1</td>
<td>1.67</td>
<td>1.67</td>
</tr>
<tr>
<td>3</td>
<td>Needle (23/26G)1/2&quot;</td>
<td>1</td>
<td>0.37</td>
<td>0.37</td>
</tr>
<tr>
<td>4</td>
<td>Gloves</td>
<td>3</td>
<td>5.36</td>
<td>16.08</td>
</tr>
<tr>
<td>5</td>
<td>Opsite 1 or 2</td>
<td>1</td>
<td>57.40</td>
<td>57.40</td>
</tr>
<tr>
<td>6</td>
<td>Suture 6.0 Silk</td>
<td>1</td>
<td>180.00</td>
<td>180.00</td>
</tr>
<tr>
<td>7</td>
<td>Suture 8.0 Vicryl</td>
<td>1</td>
<td>384.00</td>
<td>384.00</td>
</tr>
<tr>
<td>8</td>
<td>Electrode</td>
<td>3</td>
<td>7.00</td>
<td>21.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>698.52</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Step II (B):** Cost of other Consumables / case:

To calculate this cost, the cost of all general, surgical and stationary and other materials used in OT which are not specific for any for any procedure was calculated and apportioned by dividing the same by total number of procedure done over the same period. (Table 3)
The calculation of electrical consumption was based on the number of electrical points and the average quantum of electricity consumed/hr/day. Electrical consumption was charged as per the latest NDMC tariff (of Rs. 6.37 unit + 10% for the maintenance charges of 11 KV substation, the supply to the hospital being from low tension feeder).

### Cost of Air Conditioning at Dr. R.P. Centre OT

1. **Operation Cost**

   This includes cost of electricity and cost of maintaining the systems. Details are as below:

   (i) Cost of electricity = Rs. 7.00 × 225 = Rs. 1575/ Hour.

   (The capacity of the system is 3 × 80 TR/unit, which is consuming 225 KW/Hour) Total cost / day = Rs. 1575/Hr. × 8 = Rs. 12600 / day

   (ii) Annual maintenance cost of A/C = Rs. 425000/- per annum

   Cost of maintenance of A/C / day = Rs. 1416.66

   (iii) Cost of Manpower @ Rs. 150 per shift in 3 shifts = Rs. 450/d

   Operation cost = i + ii + iii = Rs.12600+1416.66+ 450 = Rs. 14230.55 / day

2. **Overheads**

   • Dt of installation – 1996
   • Cost of equipment = Rs. 683000.
   • Depreciation @ 10% = Rs. 68300
   • Cost of equipment / day = Rs. 2276.66

   [This includes (HEPA) filters, micro filters, prefilters, controls, piping manpower, sundrying items]. Cost of Air Conditioning/day = Rs. 14230.55 + Rs. 2276.66. Cost of A/C per patient per day = Rs. 257.92.

### Cost of Linen items and laundry:

There is a centralized laundry in the A.I.I.M.S. and its services are utilized by the main hospital and as well as by all the centres. The Cost of lines items and laundry was calculated as follows Cost of laundering - The cost for laundering per piece of linen was found to be Rs. 7.40/-
piece in the year 2003. Accordingly the total cost of linen and laundering in Dr. R.P.C. OT is as shown in Table 7 below:

**(f) Cost of Water Consumption: (Table 8)**

The cost of water consumption was calculated as latest Delhi Jal Board tariff, applicable for non domestic connection.

**TABLE 8 : Cost of Water Consumption in Dr. R.P.C. OT**

| Total water consumption of Dr. R.P.C. OT per year | 23.80 × 300 = 5555.33 KL |
| Cost of water consumption of Dr. R.P.C. OT (as per Delhi Jal Board tariff) | Rs. 82961.11 |
| Cost of water consumption per patient per year | Rs. 4.28 |

**(g) Cost of Manpower:**

To calculate this cost, average number of faculty and residents working on any table was ascertained. The salaries of one day were calculated to work out cost of manpower per 8 hour.

(a) Faculty and resident are spending full 8 hours per day in the operation theatre and hence 100% of salary of the average number of faculty members and residents working on any day on a OT table was calculated and apportioned towards the procedure on the basis of actual time taken for selected procedure.

(b) Similarly the average number of Nursing, Group-D and other OT Staff working on any day on any OT table was ascertained. Since they spend full 8 hours in the OT, the 100% of their salary was calculated and apportioned towards the procedure on the basis of actual time of the surgery.

*The Manpower Cost in Dr. R.P. Centre Operation Theatre*

| Cost of manpower per hour | Rs.1736.50 |

**(i) Steam Sterilization and ETO installation**

The services of Central Sterile Supply Department are used not only by Dr. R.P. Centre but also by main hospital and other centers. CSSD performs two major functions i.e. sterilization and packing.

The final products are quantified as trays, packets or drums. The CSSD costs are to be apportioned amongst the user wards, OPD and operation theatres (Table 9).

**(ii) Ethylene oxide (ETO) Sterilization (Table 10)**

No centralized ETO facility exists in A.I.I.M.S. The ETO sterilizers have been installed in a single sterilization side room located on the 5th floor in the OT complex. Table top installation with no special infrastructure is required. The machines are operated by an OT technician specially designated for the purpose. The supervision and documentation is done by a nursing staff.

**TABLE 10 : Cost of Ethylene Oxide Sterilization**

| Total cost of ethylene sterilization per annum. (This includes annual depreciated building cost, maintenance, rental cost, manpower, electricity, equipment, material, water & supplies) | Rs. 278875.00 |
| No. of packs sterilized per year | 19500 |
| Cost of sterilization per pack per pack | Rs. 14.30 |

The total number of packs being sterilized per patient = 1

Cost of Ethylene sterilization per patient in selected cases = Rs. 14.30

Total cost of Instrument & Linen sterilization per patient = (i) + (ii) = Rs. 34.96 + Rs. 14.30

**(i) Costing of Medical Gases**

To calculate this cost, only the cost of medical gases consumed in Dr. R.P. Centre OT was calculated (Table11).

**TABLE 11 : Show the Consumption of Oxygen and Nitrous Cylinder Per Patient in Dr. R.P. Centre OT**

| Cost of Oxygen & Nitrous Cylinders | Rs. 1439451.16 |
| Cost of medical gases per patient | Rs. 74.39 |

The total cost incurred for squint procedures is shown in table 12.

**TABLE 12 : Costs Constituting the Total Cost of Squint Procedure**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Cost Head</th>
<th>Cost Head (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Uniform Costs per procedure in OT</td>
<td>1. Cost of OT Building</td>
<td>94.80</td>
</tr>
<tr>
<td>2. Cost of machine, equipment &amp; fixtures</td>
<td>703.44</td>
<td></td>
</tr>
<tr>
<td>3. Cost of Electrical Consumption</td>
<td>208.84</td>
<td></td>
</tr>
<tr>
<td>4. Cost of Water Consumption</td>
<td>4.28</td>
<td></td>
</tr>
<tr>
<td>5. Cost of A/C</td>
<td>257.92</td>
<td></td>
</tr>
<tr>
<td>6. Cost of CSSD &amp; ETO Sterilization</td>
<td>49.26</td>
<td></td>
</tr>
<tr>
<td>7. Cost of Medical gases</td>
<td>74.39</td>
<td></td>
</tr>
</tbody>
</table>

| B. Special Costs in Squint Surgery per case | 8. Cost of consumables & special consumables | 846.38 |
| 9. Cost of Special Surgical Instruments per case | 3.20 |
| 10. Cost of Linen & Laundering per case | 347.16 |
| 11. Cost of Manpower | 955.08 |
| Total | 3544.75 |
Limitations

1. As there is no established cost accounting system in place so it is difficult to allocate cost for different cost centre.

2. The OPD and inpatient costs have not been included in this particular study.

Discussion

In absence of Mercantile Accounting System at AIIMS, staff is not aware of the cost of different hospital services and in a study conducted to know cost awareness on the consumables used for the patient treatment, amongst medical personal at AIIMS hospital it was observed that only 53-66% of item were aware about the cost of drugs and material supplied. This study also revealed that where the information about the cost of a treatment procedure is made available, there is increased awareness amongst personal directly engaged in patient care activities. This awareness leads to rational use of facility and better utilization of resources. Cost accounting system\(^5,6\) provides information, which is required for need based scientific budgeting and for performance budgeting too. There has been shift in government policy, whereby organizations are encouraged to generate resources from the affluent section of the society in the form of user charges to subsidize cost for the under privileged. One such strategy is the introduction of package System for various procedures in the hospital. The success of package system in the CN Centre at AIIMS has encouraged the hospital administrators to consider the application of this in other areas of the hospital.\(^7,8\) It was found that the cost per case is less in tertiary care ophthalmic hospital than in other major private hospitals of Delhi. If we make bulk purchase and give the patients a package, the cost of consumables to be used for surgery and the drugs to be taken after operation would comes out to be cheaper as compared against the private hospital, where charges are higher. For example, the estimated cost per procedure of Squint Surgery in A.I.I.M.S after adding manpower cost, cost of consumables, along with the overhead charges of OT comes is Rs. 3544.75/-, where as it is approximately Rs.20,000 – 30,000/- (excluding the cost of Bed Occupancy) in a multi-speciality corporate hospital. The comparisons reveal that, if tertiary care ophthalmic hospital charges are revised taking into account, the actual cost incurred and packages are offered for different surgical procedures, A.I.I.M.S can start generating additional revenue. Patients who are well to do will be ready to pay, as quality of clinical care at Dr. R.P. Centre is perceived to be better.

Conclusion

The study shows that certain cost centres are at present contributing quite substantially to the total costs. There is need for generating cost awareness and initiate measures to reduce costs wherever feasible by adopting modern management technique. This will help in optimizing use of budgetary allocation. In the present set up, the component of overheads is quite high. By increasing utilization of OT timings, cost of these overheads can be reduced leading to overall decrease in cost of surgeries. This can be done by increasing OT timing by augmenting manpower. At present there is lack of awareness amongst the hospital staff regarding cost involved in providing patient care. The cost awareness programme should be started in the hospital to make hospital staff aware of the cost involved for providing patient care so that they take proper care to reduce the wastage and make optimum use of the resources available. This study highlights that there is need to develop cost accounting and hospital management information so that decision making can be based on the basis of costs leading to better utilization of resources.

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OCTOPUS: Our Co-MICS Technique of One Percent Ultrasound

Taru Dewan MS, FRCS, PK Malik MS, Anshu Anind MBBS, Shyam Gupta MS, MBBS

Corneal endothelial damage and posterior capsular rupture are two most undesirable complications of cataract surgery. Significant loss of endothelium can lead to corneal decompensation and loss of corneal clarity. However, some degree of endothelial cell loss is inevitable after any cataract surgery. A loss of 3.2%-23.2% has been shown in various studies. It is well known that during cataract surgery many different factors can generate endothelial damages, which include impact of the nuclear fragments, intraocular lens (IOL) and instruments infusion fluid volume, the turbulence generated in anterior chamber the release of free radicals incision length surgical technique and high density cataract. It is also related to the amount of ultrasonic energy used and the subsequent temperature rise.

In addition to improvements in instrumentation, ophthalmic viscosurgical device (OVDs) and IOL designs, there has been constant and conscious effort on the part of phaco surgeons to reduce their phaco time by bringing some alteration or innovation in their personal technique.

Technological innovations so far aim at reducing absolute phaco time by reducing the total ultrasound time by either:

a) Modifications of phaco power duration
   - Burst mode
   - Ocuburst mode
   - Ocupulse mode
   - Micropulse and hyperpulse

b) Or increasing efficacy with better tip designs like OZIL/ELLIPSE

c) Other attempts in this direction are by combining alternate modalities with phacoemulsification to reduce usage as the:
   - Sonic phaco: sonic + ultrasound (US)
   - Phacotmesis (water jet + US)
   - Femtosecond laser (laser + US), or combining alternate strategies

However they all share a common mind set when it comes to hard cataract, that is working at higher power settings. This is the mindset that we propose to change with OCTOPUS.


The usual settings of octopus are as under:

- Phacopower 1%
- Micropulse mode
- Dutycycle 30
- Vaccum* 300

*Vaccum settings may be changed to 250 when using a standard tip instead of CoMICS

Use of 1% ultrasound even at continuous mode is a 95-97% reduction from existing power settings on most machines. In addition the use of footpedal modulation and micropulse mode makes the average phacopower much below 0.30%. In effect this means that we reduce phaco energy usage to bare minimum.

Coaxial microphacoemulsification is the standard phacoemulsification technique being practised globally for cataract extraction. Coaxial MICS fully utilizes the advantages of small incision and provides the most comfortable platform for the surgeons using conventional phacoemulsification. OCTOPUS thus combines the advantage of energy delivery close to nil with the comfortable platform of CoMICS.

In a pilot study at our institute to compare the phacoemulsification using OCTOPUS versus Standard Coaxial MICS with 40% power a total of 62 eyes were enrolled after ethics committee approval. Statistical analysis revealed no significant difference between the two groups in terms of total ultrasound time (p> 0.67), infusion fluid volumes (p>0.86) and endothelial cell counts upto one month follow up (p> 0.12).

The mode of action of ultrasound has been explained by various theories. One talks about acoustic breakdown of lenticular material as a result of wave propagation through fluid medium. Another theory concerns the implosion of microcavitation bubbles produced at distal phacotip (more at a lower ultrasound) and jackhammer or mechanical breakdown of lens material by tips axial oscillation (more...
at high frequency). The hardness of any state of matter is related to the density of its particles and if the correct vibratory motion is imparted to the particles then the state of matter can change into a softer form. We found that use of 1% power at frequency of 40 kHz is enough to emulsify all grades of nuclei and enable aspiration at high vacuum settings as demonstrated by OCTOPUS. It also maintains the patency of aspirating system to achieve comfortable flow of fluid and fragments.

We envisage that all future phacoemulsification users would use OCTOPUS settings to add to the advantage of nearly abolishing power usage to other modifications of surgical technique. The same can be extrapolated to higher end surgeries with femtosecond where present fragmentation module reduces phacotime by 40-50%. Use of OCTOPUS abolishes the need for laser fragmentation and reduces absolute phaco time (APP) by more than 97%.

References

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Delhi Journal of Ophthalmology
Epibulbar Dermoid in Goldenhar Syndrome

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DOI: http://dx.doi.org/10.7869/djo.2012.91

Figure 1: Limbal dermoid; Figure 2: Immersion Ultrasonography of Limbal Dermoid; Figure 3: Anterior segment OCT showing stromal involvement > 50% with no invasion of angle structures; Figure 4: (a) X-ray cervical spine showing loss of lumbar lordosis with blocked vertebrae; Figure 4 (b-c): Normal X-ray skull; Figure 5(a-b): Polydactyly on right side, confirmed on X-ray; Figure 6(a-d): Steps of excision biopsy of limbal dermoid in toto; Figure 6(e): Final postoperative appearance; Figure 7(a-c): Gross specimen of the excised mass; H & E stained section showing thick bundles of collagen with abundant adipose tissue in dermis. Epidermis shows skin appendages (hair).

Epibulbar limbal dermoids are frequently intercepted in routine ophthalmology clinics but few show complete syndromal involvement and typify the classic Goldenhar Syndrome as described in conventional teaching. Authors take this opportunity to present a common, yet classical case of Goldenhar syndrome with complete systemic involvement. A 24 year old hindu housewife presented to the outpatient clinic at our institute with primary complaints of a pinkish mass in her right eye encroaching onto the black part. This was present since birth and was gradually increasing in size for past 6 months and was cosmetically disfiguring. She gives no history of incidental trauma or any ocular intervention. The mass had progressed from an initial size of a mustard seed to the present configuration. There was no pain or recurrent redness over the mass. Surrounding skin stayed unchanged with no discoloration or abnormal hair growth in relation to the mass. On further enquiry, a history of deafness since childhood and recurrent
pain and watery discharge from the right ear was found but no treatment had been sought for the same besides some unknown homeopathic remedies. She also had an extra thumb in her right hand. No other external deformity was evidenced. No family history of similar defect in siblings and no history of drug abuse or teratogenic exposure during prenatal period was present.

On ocular examination, unaided visual acuity was 6/60 and 6/6 in right and left eye respectively. Manifest retinoscopy was oblique in right eye, with value of +2.5 at 135 degrees and +4.5 D at 45 degrees. Values of +2.0 D and +1.5 D were noted at 90 and 180 degrees in the left eye. Right eye neither improved with pinhole nor with refraction. Left eye was 6/6 with -0.5 D Cylinder at 90 degrees. Right eye manual keratometry (K) showed a steep vertical axis of 44.0 Diopters, being 41.5 D in the horizontal meridian, giving an astigmatism of 2.5 D. Astigmatism was less in the left eye, with a value of 1.0 D; horizontal K measuring 42.0 D and vertical being 41.0 D. A pinkish white dome shaped limbal nodule was present temporally from 7-11 o’clock hours, 6 x 6 mm in size, extending 2 mm into clear cornea (Figure 1). Its surface was keratinized, with superficial vascularization and hair. Mass was soft in consistency, non tender and freely mobile over the sclera, not involving the fornices. Gonioscopy was done and angles were open; though area involving the mass could not be examined properly. Immersion ultrasonography showed high intensity spikes anterior to conjunctiva and cornea. No intraocular extension was seen (Figure 2). These findings were confirmed on anterior segment optical coherence tomography (OCT) which showed stromal involvement of >50% without involvement of angle structures (Figure 3).

Anterior chamber, lens and fundi were normal. She was an average built young lady with normal facies. X-Ray cervical spine revealed loss of normal lordosis with blocked cervical vertebrae C3-C6 (Figure 4 a). Xray skull was normal (Figure 4 b). No external ear deformities or preauricular tags were seen. Cardiovascular, respiratory, central nervous system and higher mental functions were normal.\(^1\) Movements were not restricted. Xray Chest and lumbo-sacral spine (Figure 4c) were normal. Right limb deformity was present in the form of polydactyly (Figure 5 a,b). Computed tomography (CT) scan of the head and orbit were normal, showing no intracranial space occupying lesion. Ultrasound Scan (USG) abdomen was anechoic with no renal malformations. Left ventricular ejection fraction was 60% on echocardiography.

All valves and chambers were normal with no lipoma or malformations. On detailed otolaryngological examination, right tympanic membrane showed central large perforation without any discharge suggestive of inactive mucosal chronic otitis media. Left tympanic membrane was retracted; attic cholesteatoma and typanosclerosis patch was seen in the inferotemporal quadrant suggestive of inactive squamosal chronic otitis media. Bilateral moderate conductive hearing loss was documented on clinical tests of hearing (Rinne-BC>AC and Weber lateralized to right side. On the basis of these findings, a diagnosis of right limbal dermoid and anisometropic amblyopia was made which was associated with bilateral moderate conductive hearing loss with blocked cervical vertebrae and polydactyly. These suggested a diagnosis of Goldenhar Syndrome with multidisciplinary involvement (eye, ears and vertebrae).

As only 50% of stroma was involved and angles were free, a simple excision biopsy of the mass in toto was done (Figure 6). Standby corneal and scleral graft was kept in case of full thickness penetration. Specimen was preserved in normal saline (Figure 7a) and sent for histopathology. Hematoxylin and eosin stained sections revealed thick bundles of collagen with abundant adipose tissue (Figure 7b), covered by dermis, with chronic inflammatory cell infiltration (Figure 7c). Epidermis was within normal limit. Skin appendages (hair follicle) were noted within. Final diagnosis of dermolipoma was made.

Dermoids localized on the limbus, cornea and conjunctiva are congenital tumors from the group of choristomas which are congenital lesions representing normal tissue(s) in an abnormal location (choristos in Greek = separated, oma = tumor) These consist of ectodermal and mesodermal elements combined in different proportions. They clinically present as whitish or yellowish solid formations, circular or oval in shape, with smooth or rough surface, either flat or protruding like a dome on the eyeball surface, often with fine hair. The most frequent site of involvement is believed to be infero-temporal segment (85%). They may be associated with colobomas, Goldenhar syndrome or epidermal nevus syndrome. They are usually unilateral, but those associated with the latter are bilateral and extensive.\(^1\) Bilateral involvements are always symmetrical. These are occasionally familial. The above mentioned case was diagnosed with Goldenhar syndrome based on presence of right limbal dermoid, with bilateral moderate conductive hearing loss with blocked cervical vertebrae and right polydactyly.

Oculo-auriculo-vertebral syndrome or goldenhar Syndrome as it is commonly known was originally defined as a triad of congenital abnormalities consisting of epibulbar dermoid, preauricular appendages and pretragal fistulae. After Gorlin, the asymmetry of the face or hemifacial microsomia was also described as an usual association of this triad.\(^2\) Early surgery with simple local resection (combined with a conjunctival flap in order to cover the bare area) is preferred to lamellar keratoplasty. Nevertheless, corneoscleral lamellar grafts may be required in advanced cases, especially when the whole thickness of the corneal stroma is involved or when the tumor deeply extends around the limbus.\(^3\)

References

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