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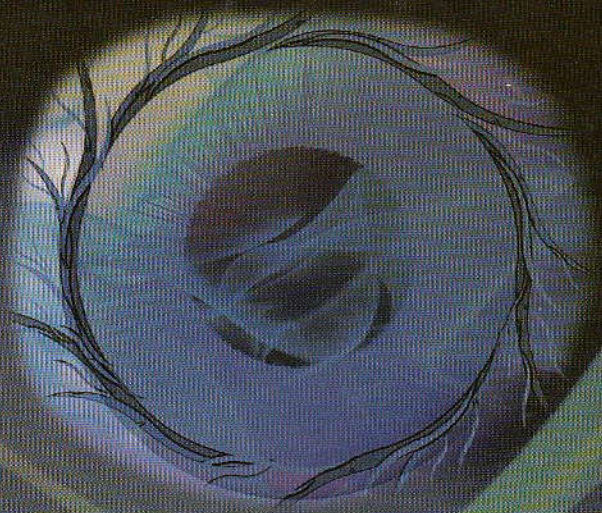

Chief Editor - Dr. Abhishek Chandra

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U.P. JOURNAL OF OPHTHALMOLOGY

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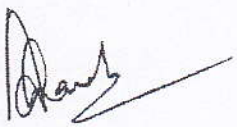
Contents

From the Editor's Desk...

Dear Friends,

It gives me immense pleasure to invite you to read the second issue of UP Journal of Ophthalmology (2017). I have been successful in bringing out the journal biannually regularly without expecting any financial support from the UP State Ophthalmological Society. The Journal has traversed a successful trajectory in the last 2 years, marked by consistent interest shown by the members in the form of scholarly contributions as well as readership. The present issue also carries articles and research papers, contributed by the members of the scientific community not only across Uttar Pradesh but also scholarly articles from various parts of the country. A range of topics, from the conventional cataract in small pupil and ocular trauma to the most recent ones like DSEK, ROP and ocular blood flow have been covered, providing updates in respective areas. Case Reports on different topics have further added to the diversity of topics discussed. I am thankful to all the contributors for their valuable contributions.

I hope the current issue will successfully further not only academic interest, but also inquiry into the respective areas of research. Hoping reading the current issue to be a thoughtful and engaging experience for all of you!



(Abhishek Chandra)

Editor, UP Journal of Ophthalmology
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Analysis of Retinal Nerve Fibre Layer Thickness with HbA1c and Blood sugar levels in Type 2 Diabetes Mellitus patients without clinical diabetic retinopathy

Deepak Soni *, Diksha Prakash **, Om Prakash Singh Maurya ***, Surya Kumar Singh****

Abstract

Objectives:

The purpose of this study is to determine the correlation of retinal nerve fibre layer (RNFL) thickness with glycosylated haemoglobin (HbA1c) and blood sugar levels among Type 2 diabetic patients without clinical diabetic retinopathy. **Methodology:** This is a cross-sectional study involving 40 patients- Type 2 Diabetic patients without any evidence of diabetic retinopathy. A total of 80 eyes were observed. Evaluation of thickness of retinal nerve fibre layer along a 3.4mm diameter circle centred on the optic nerve head using SD-OCT in diabetic patients without clinical retinopathy. Comparison of the RNFL between patients with HbA1c <6, 6-7, >7 & with fasting blood sugar & post prandial blood sugar levels & which quadrant is maximally affected. **Results:** The decrease in the thickness in the average RNFL thickness is affected by raised HbA1c levels, raised Fasting Blood Sugar (FBS) & Post Prandial Blood Sugar (PPBS) levels (poor glycemic control). **Conclusion:** Non proliferative Diabetic Retinopathy in type 2 Diabetes mellitus patients appears to have thinner RNFL thickness and is significantly correlated with high level of fasting & post prandial blood sugar levels & glycosylated haemoglobin levels.

Abbreviation:

RNFL: Retinal Nerve Fibre Layer; HbA1c: Glycosylated Haemoglobin; LDL: Low Density Lipoprotein; NPDR: Non-Proliferative Diabetic Retinopathy; HRT: Heidelberg Retina Tomograph; OCT: Optical Coherence Tomography; ELISA: Enzyme- Linked Immunosorbent Assay; Hb-AGE: Haemoglobin Advanced Glycation End-Products; ApoB: Apolipoprotein B

INTRODUCTION-

Diabetes mellitus is the leading cause of new cases of blindness among adults aged 20 to 74 years. Diabetic retinopathy (DR) is a vascular disorder affecting the microvasculature of the retina. It is estimated that diabetes mellitus affects 4% of the world's population, almost half of whom have some degree of DR at any given time. DR occurs both in type 1 & type 2 Diabetes mellitus and has been shown that nearly all type 1 and 75% of type 2 DM will develop DR after 15 years of duration of diabetes[1,2].

Prevalence of DR in Winconsin epidemiological study of diabetic retinopathy (WESDR)[3] was 99% in Insulin dependent diabetes mellitus (IDDM) & 60% in Non Insulin dependent diabetes mellitus (NIDDM) Prevalence of DR was 54.2% in the Diabetes Control and Complication Trial (DCCT) study in IDDM[4] and 35-39% in United Kingdom Prospective Diabetes study in NIIDM[5]. Majority of the patients have NIIDM or type 2 diabetes. In two studies from south India, done in 2004 the prevalence rate of DR in NIIDM patients were 34.1% and 37% [6,7] . India has more than 62 million diabetic subjects at present as per WHO estimates[8]. In the Andhra Pradesh Eye Disease Study (APEDS) of self reported diabetics the

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prevalence of DR was 22.4%. in the Chennai Urban Rural Study (CURES), done in 2005 they evaluated the urban sample of diabetic patients and estimate the overall prevalence of DR as 17.6% [9].

Particularly vision loss in diabetes mellitus is seen in uncontrolled glycemic levels. Moreover, once set in, requires frequent ophthalmic examination and high cost drugs (eg. Bevacizumab) for treatment. However it is preventable by achieving the glycemic control and reducing the disease duration.

Normal vision depends on the normal function of the retinal neurons to produce a good quality of vision. The quality of vision starts to deteriorate early in diabetes, before the clinical retinopathy becomes evident, probably indicating the early signs of neuronal dysfunction. Retinal nerve fibre layer (RNFL) is an important structural neuron in the retina layer which is often shown to affect in the early pathogenesis of diabetic retinopathy. Several studies have reported RNFL thinning or defects in people with diabetes[10,11,12,13,14]. Histological studies of neural components of the retina have revealed that diabetesinduced biochemical mechanisms can potentially cause neural cell degeneration [15-16]. An in-depth understanding of the vascular changes in the retina during diabetes has given cause for the treatment of diabetic retinopathy. Indeed, the only proven treatment for diabetic retinopathy apart from intensive insulin therapy is laser photocoagulation, which involves the destruction of the retinal regions which contains overt vascular abnormalities [17]. Subsequently, early detection of RNFL thinning may help ophthalmologists to provide effective treatment of diabetic retinopathy and with early prevention, thus reducing vision loss.

HbA1c is glycosylated haemoglobin. It is formed due to non enzymatic glycation pathway by hemoglobins exposure to plasma glucose and reflects the blood glucose over the last 8 to 12 weeks. In diabetes mellitus, higher amount of glycated haemoglobin, indicating poorer control of blood glucose levels, have been associated with cardiovascular disease, nephropathy, and retinopathy. Monitoring HbA1c levels may improve outcome[18].

Spectral domain OCT allows for non invasive in vivo cross sectional image of ocular structure such as retina, RNFL and optic nerve head. Spectral domain OCT applies the principle of interferometry to determine the interface between different ocular tissue. Using automated segmentation algorithms based on reflectivity changes between adjacent retinal layers, the RNFL thickness can be calculated[19,20,21,22,23].

"Thus the purpose of study is to evaluate if poorly controlled diabetes –as reflected by high recent HbA1c levels causes thinning of the nerve fibres & to asses if there is a significant correlation between raised fasting & post prandial blood sugar level with the retinal nerve fiber layer thickness."

METHODS-

Study profile-

Department of Ophthalmology, Sir Sundar Lal Hospital, Institute of Medical Science, Banaras Hindu University, Varanasi & Department of Endocrinology Sir Sundar Lal Hospital, Institute of Medical Science, Banaras Hindu University, Varanasi. Patients attending Department of Ophthalmology OPD & Department of Endocrinology OPD Sir Sundar Lal Hospital, BHU. Study period between 01-09-2015 to 30-06-2017. 40 patients- Type 2 Diabetic patients without any evidence of diabetic retinopathy. A total of 80 eyes were observed. Cross sectional, hospital based study.

INCLUSION CRITERIA:- Cases-

- Type 2 Diabetic patients of both sexes without retinopathy receiving treatment at OPD clinic of S. S. Hospital BHU, Varanasi.
- Only adults (>18years of age)

EXCLUSION CRITERIA:- Patients having ophthalmoscopic conditions where evaluation of fundus by

+90D or +78D lenses, indirect ophthalmoscopy and spectral domain OCT procedures cannot be possible (like Nuclear sclerosis grade 3 & onward cataracts, complicated cataracts, cortical cataracts & dense media opacities which hinders the evaluation)

STUDY PROCEDURE-

Fundus photograph was taken for grading of non-proliferative diabetic retinopathy based on proposed International Diabetic Retinopathy Severity Scales . The subject underwent the RNFL thickness measurement using Spectral-Domain OCT (Cirrus HD-OCT, Carl Zeiss Meditec, Dublin, CA).

STATISTICAL ANALYSIS-

Statistical analysis was performed using **IBM® SPSS® Statistics 19.0.0 software. Master chart** was prepared by Microsoft excel & then loaded onto the SPSS software. Descriptive statistical analysis was performed to prepare different frequency tables and to calculate the means with corresponding standard errors. Pearson Chi Square test was applied as measure of association. $P<0.05$ was taken to be statistically significant.

RESULTS-

Total number of patients studied is 40. Both eyes of the patient were studied (80 eyes)

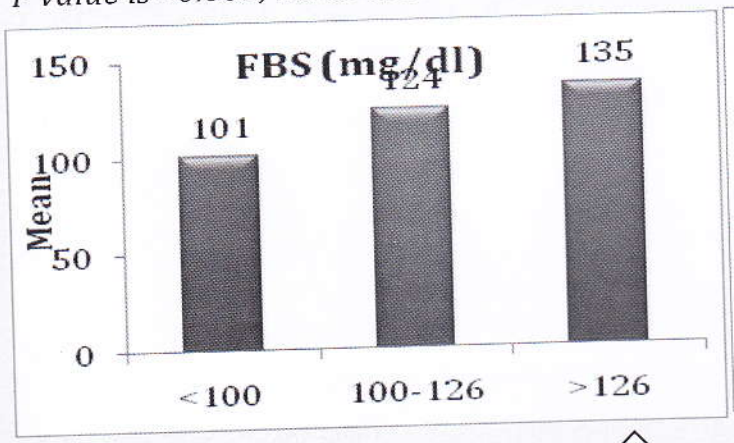
Table 1 - Showing age distribution among the study group

Age in years	Count	Percentage
31-40	6	7.5
41-50	20	25
51-60	44	55
61-70	10	12.5

Table 2 - Showing statistical correl ation between Fasting blood suga r (FBS) with Retinal Nerve Fibre Layer Thickness (RNFL) in all quadrants

FBS (mg/dl)	—	f-value	p-value
<100	101.00±12.336	32.827	<0.001
100-126	124.00±13.543		
>126	135.00±11.015		

P value is <0.001, hence the result is statistically significant



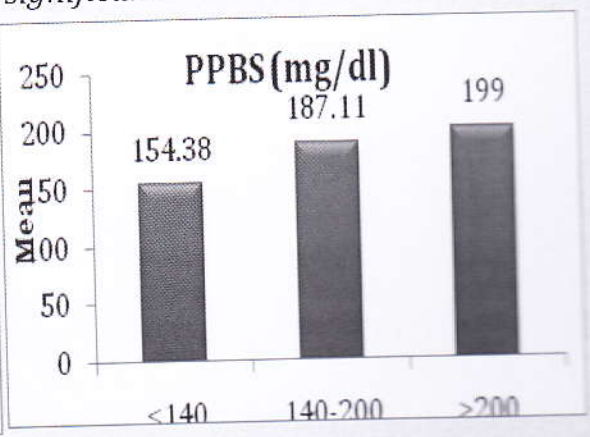


Table-3 Showing statistical correlation between post-prandial blood sugar (PPBS) with Retinal Nerve Fibre Layer Thickness in all quadrants

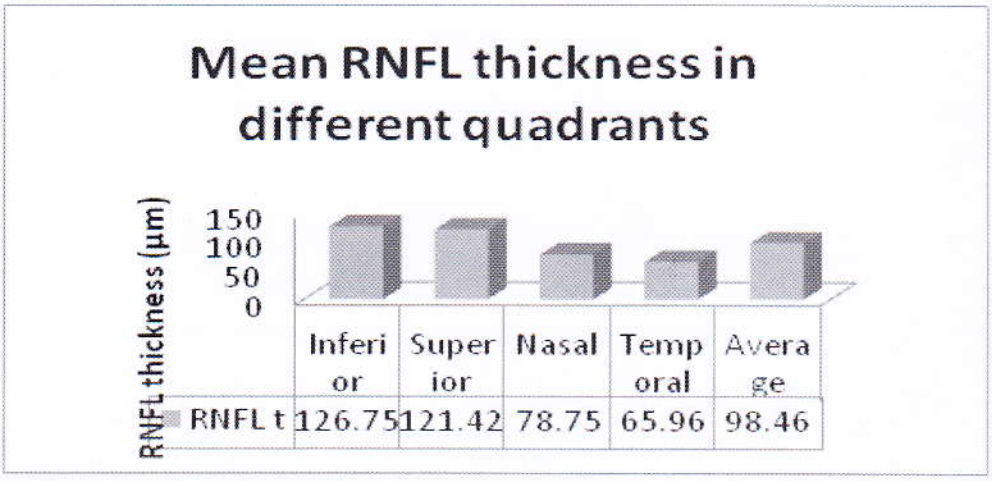
PPBS (mg/dl)	Mean±SD	f-value	p-value
<140	154.38±20.827	21.184	<0.001
140-200	187.11±24.523		
>200	199.00±19.900		

P value is <0.001, hence the result is statistically significant

Table 4- Showing statistical correlation between various age groups with HbA1c

	Value	Df	Asymp. Sig. (2- Sided)
Pearson Chi-Square	13.342[a]	6	0.038
Likelihood Ratio	14.241	6	0.027
Linear-by-Linear Association	0.003		
N of valid Cases	80		

P value is 0.038, hence the result is statistically significant.



Showing Mean Retinal Nerve Fibre Layer Thickness in all quadrants (in µm)

Retinal Nerve Fibre Layer Thickness in each quadrants:

The average RNFL thickness in each quadrant was available as continuous data. As Heidelberg tomogram machine has age matched data fed in its database a normal range of RNFL cannot be defined for comparison between the different age groups. Hence the data is converted into ordinal form.

70% of the 80 eyes have RNFL thickness within 2 SD (Green-G)

24% of the 80 eyes have Borderline RNFL (Yellow-**Y**)
6% of the 80 eyes have decreased RNFL (Red-**R**)
P value is <0.001, hence the result is statistically significant.

Table 6- Showing comparison of Average RNFL thickness with HbA1c

AVERAGE RNFL thickness	HbA1c			Total
	<6%	6-7%	>7%	
G	40	11	5	56
Y	3	8	8	19
R	1	1	3	5
Total	44	20	16	80

Table- 7 Showing statistical correlation between Average RNFL thickness with HbA1c

	Value	Df	Asymp. Sig. (2- Sided)
Pearson Chi-Square	35.14	4	<0.001
No. of valid Cases	80		

P value is <0.001, hence the result is statistically significant.

DISCUSSION-

Advances in ocular imaging technology have made it possible to evaluate the RNFL thickness in an objective, quantifiable, and reproducible fashion, Optical Coherence Tomography (OCT), which uses short coherence length interferometer, has a fine resolution (up to 2 microns) and reflects the histologic characteristics of the tissue. Because OCT is based on the cross sectional image of the retina, the instrument measures the nerve fibre layer directly, has no need for a reference plane, and is known to be unaffected by the refractive status, axial length of the subject, sclerosis of the lens, or pupillary dilation. The only limitations of OCT imaging are the uncertainty of the assumed group refractive index of tissue, the effect of eye movements during the B-scan location, and the interface detection artifacts. The Cirrus HD-OCT, Carl Zeiss Meditec, Dublin, CA has eye tracking system and it negate the effect of the eye movements. To avoid any influence of the eye movements , we observed the scanned eye software interface detection artifacts, we inspected every B-scan and repeated the scan if we noticed any eye movements. To avoid software interface detection artifacts, we inspected every B-scan after acquisition and repeated the scan if the software was unable to detect the RNFL borders.

Previous studies have shown that in patients with diabetes mellitus, poor glycemic control leads to infarction in the nerve fibre layer leading to axonal degeneration and decrease in the number of optic nerve axons and the number of retro-bulbar optic nerve fibres[100-103].

In vivo studies of the retinal nerve fibre layer have shown both broad and slit like defects, suggesting that retinal nerve fibre loss and optic nerve fibre loss are related to subclinical vision loss in diabetic patients without any clinical retinopathy.

The purpose of our study was to measure-

The retinal nerve fibre layer (RNFL) thickness in diabetic patients without retinopathy and in relation to the glycemic levels. During study period 80 eyes of 40 patients with type 2 diabetes mellitus without any diabetic retinopathy changes were evaluated. Fasting blood sugar (FBS), post prandial blood sugar (PPBS) & HbA1c of each patient were considered as glycemic status markers. All the three parameters were correlated with average RNFL thickness.

Using the spectral domain OCT in this study, we were able to detect significant decrease in average RNFL thickness measurement in Type 2 diabetic patients without any clinical evidence of diabetic retinopathy.

The final results are-

I. Statistical correlation between FBS and RNFL thickness in different quadrants- P value is <0.001. Hence the result is statistically significant. (Table 2)

II. Statistical correlation between PPBS and RNFL thickness in different quadrants- P value is <0.001. Hence the result is statistically significant. (Table 3)

III. Statistical correlation between Average RNFL thickness with HbA1c- P value is <0.001, hence the result is statistically significant. (Table 6 & 7)

Our findings were in parallel to other studies done by Takahashi et al. [24] and Tekeli et al.[25]. In study done by Tekeli et al., HRT was used to evaluate optic nerve head parameter in diabetes mellitus with and without retinopathy. Whereas, Takahashi et al. used the stratus OCT which is a different tool compared with our study. Both studies did not find any significant reduction in the RNFL thickness among subjects of mild to moderate NPDR compared with age-matched healthy subjects.

Our results were fairly similar to studies done by Lopes de Faria et al. [27] and Takahashi et al. [26], which disclosed that RNFL was thinner in the superior quadrant. This finding corroborates with previous study by Kern[28] showing that the early events of diabetic retinal disease (micro aneurysms and acellular capillaries) occur preferentially in the superior temporal quadrant rather than in inferior areas[28]. Among other studies, Chung et al. demonstrated that blood flow in the superior temporal retina increased in response to hypercapnia, but did not decrease in response to hyperoxia. In contrast, hyperoxia led to a decrease in blood flow to the inferior retina, whereas hypercapnia did not result in an increased blood flow within this area[28]. The lack of normal vasoconstrictor response in this superior quadrant could explain why this region is more susceptible to micro aneurysms and acellular capillaries in diabetes mellitus and also why the retinal fibres are preferentially lost in this region even before clinically detectable diabetic retinopathy[27]. Sugimoto postulated that the superior quadrant was more susceptible to undergoing damage compared with other areas and may have a tendency for higher rates of cell death, which results in RNFL thinning[29]. Besides this, we also noticed that the least affected RNFL in nasal quadrant might be due to the lack of micro aneurysm presence in this area and therefore less retinal nerve fibre layer damage occurred in this quadrant.

HbA1c is known as an index of mean blood glucose in fasting and the postprandial state[30], and is well established and widely used as a clinical measure of chronic glycemia[31]. HbA1c of 6.5% has now been seen as sufficiently sensitive and specific to identify individuals who are at risk of developing diabetic retinopathy[32]. From our findings, we noted that the majority of our subjects in diabetic patients without retinopathy changes had poor glycemic control. The majority of them had HbA1c ≥ 6.5%. Our results of mean HbA1c were fairly consistent with other studies[28,32].

We find out significant decrease in average RNFL thickness measurement in relation to HbA1c level in Type 2 diabetic patients without any clinical evidence of diabetic retinopathy. Our findings were in

contrast to other studies by Chihara et al. [36] and Peng et al. [35]. However our findings were fairly similar to study conducted by Ozdek et al. [37] who compared diabetic patients whose blood glucose was well regulated and with those who were not well regulated according to the levels of blood glucose, HbA1c, fructosamine and triglyceride. They found that the average RNFL thickness value obtained by scanning laser polarimetry was reduced in patients without diabetic retinopathy who had poor blood glucose control but not for those with good control.

CONCLUSION-

Using the spectral domain OCT in this study, we were able to detect significant decrease average RNFL thickness measurement in Type 2 diabetic patients without any clinical evidence of diabetic retinopathy. The decrease in the thickness in the average RNFL thickness is affected by raised HbA1c levels, raised Fasting Blood Sugar & Post Prandial Blood Sugar levels (poor glycemic control).

A large population cohort study is needed to establish the correlation between HbA1c & oxidised LDL and RNFL thickness & central macular thickness in the management of blood sugar levels & lipids in diabetic patients respectively.

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A COMPARATIVE STUDY OF OCULAR BLOOD FLOW PARAMETERS IN POAG, PACG AND CONTROLS IN A TERTIARY CARE EYE CENTRE

Mohan Shalini, MS,DNB, **DubeyNoopur, MBBS, ***Gupta Ramesh Chandra, MS, ****Kushwaha RN, MS, *****Khan Perwez, MS, ******Singh Parul, MS

ABSTRACT

AIM

To measure ocular blood flow (OBF) in glaucoma patients using Color Doppler Imaging (CDI) and to compare theOBFparameters with age- matched controls.

METHOD

17 patients (34 eyes) with Primary open angle glaucoma (POAG), 14 patients (20 eyes) with Primary angle closure glaucoma(PACG) and 17 (34 eyes) controls were recruited. Peak systolic velocities (PSVs), end diastolic velocities (EDVs) and resistive indices (RIs) for the ophthalmic artery (OA), the central retinal artery (CRA) and the short posterior ciliary arteries (SPCAs) were measured using CDI.

RESULT

Mean age, mean Intraocular pressure (IOP), mean systolic blood pressure (SBP) and mean diastolic blood pressure (DBP) were comparable among the groups ($p<0.05$). In OA, mean PSVs (in cm/s) were 22.81 ± 6.89, 23.72 ± 3.31, 25.83 ± 2.59; mean EDVs (cm/s) were 6.03 ± 2.72 ,7.87 ± 1.35 ,10.90 ± 1.88 and mean RIs were 0.73 ± 0.07, 0.66 ± 0.04, 0.58 ± 0.06 in POAG, PACG and Controls respectively. The difference in mean PSVs, mean EDVs and mean RIs was statistically significant between POAG vs controls ($p<0.05$) and between PACG vs controls but insignificant between POAG vs PACG.

In CRA, mean PSVs (cm/s) were 11.12 ± 3.10, 9.27 ± 2.35, 12.87 ± 2.52; Mean EDVs (cm/s) were 3.33 ± 1.18, 2.993 ± 0.95, 5.75 ± 0.88 and Mean RIs were 0.69 ± 0.08, 0.68 ± 0.04, and 0.53 ± 0.05 in POAG, PACG and controls, respectively. The difference in mean PSVs, mean EDVs and mean RIs was statistically significant between POAG vs controls and PACG vs controls. The difference was statistically insignificant when same parameters were compared between POAG vs PACG.

In SPCAs, mean PSVs (cm/s) were 9.85 ± 2.73, 9.58 ± 1.85, 11.61 ± 2.76; mean EDVs were 3.05 ± 1.26, 4.21 ± 1.26, 6.59 ± 1.93 and mean RIs were 0.70 ± 0.07, 0.56 ± 0.08, 0.41 ± 0.14 in POAG, PACG and controls respectively. The difference in mean PSVs, mean EDVs and mean RIs was statistically significant between POAG vs controls and between PACG vs controls.

CONCLUSION

Both POAG and PACG wereconsistently associated with decreased blood flow velocities andincreased RIs in retrobulbar vessels. This association is more prominently seen in POAG as compared to PACG.

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Financial disclosure: None

Key words:

Ocular blood flow, color Doppler imaging, peak systolic velocity, end diastolic velocity

INTRODUCTION

Glaucoma is the leading cause of irreversible blindness affecting more than 60 million people worldwide. [1]

It is a progressive optic neuropathyinvolving characteristic structural changes of theoptic nerve and characteristic visual field defects.[2]Raised IOP is regarded as the most important risk factor in the development and progression of glaucoma. But reducing the IOP does not ensure the cessation of the disease progression.[3–7]That is why other risk factors are thought to contribute in glaucomatous optic neuropathy.

Vascular factors have also been implicated in the development of glaucomatous optic nerve damage.[8] The vascular hypothesis suggests a primary problem in the optic nerve circulation as a result of localized organic changes in the blood vessels of the nerve. [9]Inability to adapt to tissue blood flow requirementsmay lead to chronically low or unstable ocular perfusion,[10]which in turn may cause ischemia, oxidative stress or both, possibly leading to glaucomatous damage to the optic nerve head.

Various techniques have been used to evaluate OBF in patients with POAG, such as scanning ophthalmoscopy,[11] scanning laser Doppler flowmetry[12, 13] and pulsatile ocular blood flow.[14, 15]Compared with these techniques, CDI has particular advantages in that it is non-invasive, is not affected by poor ocular media, requires no contrast or radiation, and has been used in ophthalmology for 20 years.[16,17] This ultrasound technique combines simultaneous B-mode ultrasound imaging with colors representing movement based on Doppler frequency shifts. It allows the assessment of blood flow velocities including PSV and EDV in the OA, the CRA and the SPCAs. In addition, RI, a measure of peripheral vascular resistance, can be calculated for each retrobulbar vessel.

SUBJECTS AND METHODS-

A hospital-based cross-sectional, observational study was done over a period of 1 year (January 2016 to December 2016).

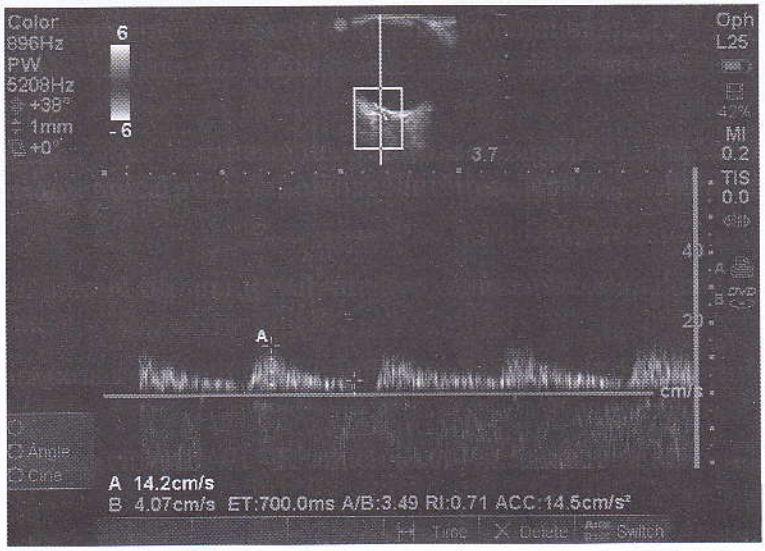
Patients with a diagnosis of POAGor PACG under topical anti glaucoma medication with adequately controlled IOP i.e. <21 mmHg (measured on two consecutive occasions separated by an interval of at least 2 hours) were included. Patients with isolated raised IOP, secondary causes of glaucoma, trabeculectomy surgery, on Carbonic Anhydrase Inhibitors/systemic antihypertensive medications and not on topical anti- glaucoma medication and/or uncontrolled intraocular pressureswere excluded from our study.

Subjects attending the outpatient clinic and having an IOP<21 mm Hg (i.e. Measured on two consecutive occasions separated by an interval of at least 2 hours, but not more than 12 weeks) with a normal optic disc were taken as controls.

The study subjects were divided into three groups i.e. POAG group (17 patients, 34eyes), PACG group (14 patients, 20 eyes) and Controls (17 patients, 34 eyes).

IOP using Goldman Applanation tonometry (GAT), SBP and DBP in the sitting posture (mean of two consecutive measurements) using a mercury sphygmomanometerwere measured for each study subject.Orbital CDI was performedusing M- Turbo Ultrasound System (Sonosite,Inc. Bothell, WA, US) in the supine position.OA, CRA, andSPCAs were examined following a standard protocol.[18, 19] OA was located by scanning medial to the optic nerve approximately 15mm posterior to the globe.CRA

measurements were taken in the middle of optic nerve 2-3 mm behind the surface of the optic disc. SPCAswere located on both sides of the optic nerve and were measured at a position that was close to the optic nerve and as anterior as possible without receiving interference from the choroid.



OBFparameters, i.e. PSV, EDV and (RI=PSV-EDV/PSV) for OA, CRA and SPCAs were recorded (**Figure 1**).

All the parameters were entered in excel sheet and were compared among these three groups.

Graph Pad Prism 7 (California, USA, version 7.00)was used for statistical analysis. Continuous data were presented as mean with a standard deviation. To compare continuous data, unpaired t-test (2 comparisons) and One way ANOVA (3 comparisons) were used. Statistical significance was set at $p< 0.05$.

RESULTS

Demographic and general characteristics of study participants are shown in table 1, table 2 and table 3. Mean age and mean IOP were comparable among the groups (p=0.412, 0.50). The difference in mean SBP, as well as mean DBP, was also statistically insignificant (p=0.962, 0.927).

OBF parameters and their comparisons are depicted in table 4 and table 5. In **OA,** mean PSV and mean EDV were significantly decreased in POAG (p=0.018, 0.0001) and PACG (p=0.01, 0.0001) groups as compared to controls. Similarly, mean RI was significantly raised in both POAG (p=0.0001) and PACG (p=0.0001) patients compared to controls.

When POAG and PACG groups were compared, mean EDV was significantly reduced in the POAG group (p=0.0006). Also, mean RI was significantly raised in the POAG group (p=0.0002).No significant difference was seen in mean PSVs between the two groups (p=0.58).

In **CRA,** mean PSV and mean EDV were significantly reduced in POAG (p=0.01, 0.0001) and PACG (p=0.0001, 0.0001) patients as compared to controls. RIs were also significantly raised in both the groups when compared with controls (p=0.0001, 0.0001).

When POAG and PACG groups were compared mean PSV was significantly higher in POAG patients (p=0.02) as compared to PACG patients. The difference in the rest of the parameters (mean EDV

and mean RI) was statistically insignificant (p=0.278, 0.64).

In **SPCAs,** mean PSV and mean EDV were significantly reduced in POAG (p= 0.01, 0.0001) as well as PACG (p=0.003, 0.0001) patients as compared to controls. Mean RIs were significantly raised in both the groups as compared to controls (p= 0.0001, 0.0001)

On comparison between POAG and PACG groups, we found significantly reduced mean EDV (p=0.002) and significantly raised RI (p=0.0001) in POAG group. The difference in mean PSVs between the two groups did not reach up to the level of statistical significance (p=0.62).

DISCUSSION

The definition of glaucoma states that the most important risk factor is the raised IOP for occurrence and progression of glaucomatous optic neuropathy. But many randomized controlled trials have shown that despite controlling IOP many patients of glaucoma keep on progressing.[20-24]

Therefore, it was thought that besides uncontrolled IOP, there are other risk factors that interplay to cause glaucoma damage and subsequentprogression. The vascular theory of glaucoma emphasizes the role of compromised OBF as one of the important factors in glaucoma progression. Therefore, this cross-sectional study was done to find out the role of vascular factors in patients with glaucoma.

In all the three vessels studied, blood flow velocities were significantly decreased and RIs were significantly increased in POAG as well as PACG patients as compared to controls.

NC Sharma, D Bangiya*et al* [25] also studied OBF parameters by CDI in healthy and glaucomatous eyes and found that mean EDV was significantly decreased and mean RI was increased in both POAG and PACG patients in CRA and SPCAs. In OA, only mean PSV was significantly decreased in POAG and PACG patients.

HakkıBirinci *et al* [26]in their study also found out that OBF velocities were significantly decreased in all the three retrobulbar vessels i.e. OA, CRA and SPCAs in POAG patients. Similarly, RIs in POAG patients were significantly raised as compared to normal subjects.

Simon J. A. Rankin *et al* [27]studied OBF in CRA and SPCAs in glaucomatous patients and found that compared with the normal subjects, the patients with chronic OAG showed a statistically significant decrease in the mean EDV and an increase in the mean RI in all vessels studied.

PrinRojanapongpun*et al* [28]studied these parameters using CDI in OA only and found out that blood flow velocities were significantly decreased in POAG patients as compared to normal subjects.

Our study also revealed that in OA and SPCAs, mean EDVswere significantly reduced in POAG patients as compared to PACG patients. Similarly, mean RIs were significantly raised in POAG patients as compared to PACG patients. While in CRA, mean PSV was significantly lower in PACG patients as compared to POAG patients. The difference in the rest of the parameters did not reach up to the level of statistical significance.

Optic nerve head is mainly supplied by the SPCAs which are branches of the OA. The contributionsfrom the CRA and the pial vessels are very small.[29] Moreover, the most reliable parameters of ONH perfusion are EDV and RI. EDV, reflecting the average blood flow during the longest phase of the

cardiac cycle, seems to be more suitable than PSV, which represents only an instantaneous variation of blood flow. [30] Thus we can infer that retrobulbarhemodynamics is more altered in POAG patients than PACG patients.

Similar to our study **NC Sharma, D Bangiya*et al*** [25] also in their study found that most of the blood flow parameters were more altered in POAG patients as compared to PACG patients.

Therefore, our study supports all these aforementioned studies in that retrobulbarhemodynamics is altered to a significant degree in the glaucoma patients. Although from this study, it is difficult to infer whether it is the cause or the effect of glaucomatous optic neuropathy. More extensive longitudinal studies are needed for that purpose.

In our study, we only recruited patients under glaucoma medications with well-controlled IOP. Increased IOP is the major cause of glaucomatous optic neuropathy and also a known factor affecting the blood flow velocities. So, we have excluded an important confounding factor from this study thus reducing the bias. We can say that this finding of altered retrobulbarhemodynamics is not the result of increased IOP. Moreover, the difference in SBP and DBP was also not significant among the groups excluding the possibility that this finding of decreased retrobulbar flow might be the result of decreased systemic blood pressures.

Therefore, in the diagnosis and therapy of POAG and PACG,it is necessary to know not only the IOP, but there is alsothe importance of the OBF velocities. If we do not take into account these additional risk factors, then glaucoma might progress despite achieving target IOP in many patients.

But it is important to mention here that these OBF velocities measured by CDI are not reflections of actual OBF. For that, we would need diameters of these vessels which are practicallyimpossible with this technique. Moreover,SPCAs being the major blood supply to ONH are the most important vessels to be studied. But CDI cannot separately measure the parameters in each of these vessels. The values obtained represent the mass effect produced by a bundle of vessels, rather than from individual ciliary vessels. Therefore, we would need a better alternative in the futurewith the same advantages as CDI.

CONCLUSION

1) Both POAG and PACG are consistently associated with decreased blood flow velocities and increased RI in OA, CRA and SPCAs compared to normal subjects.
2) There is a more significant association of decreased velocities and raised RI in retrobulbar vessels with POAG patients as compared to PACG patients.

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Legends:

Table 1- Number of study participants.

Table 2- Sex distribution of study subjects.

Table 3-General Characteristics of Study Subjects

Table 4- Blood Flow Parameters in Retrobulbar Vessels Using CDI

Table 5- Comparison of Blood Flow Parameters among the Groups: Statistical Significance (p Values)

Figure1: Ocular Blood flow Parameters

A= PSV, Peak Systolic velocity

B= EDV, End diastolic velocity

A,B = RI, Resistivity Index

Table 1Number of Participants

	POAG*	PACG†	CONTROLS‡
Number of subjects	17	14	17
Number of eyes	34	20	34

*Both eyes were affected in all the participants.
†One patient was uniocular and only one eye was affected in 6 patients.
‡Both eyes of all the subjects were included.

Table 2Sex Distributions*

	Male	Female
POAG	10(58.82%)	7(41.17%)
PACG	7(50.0%)	7(50.0%)
Control	11(64.70%)	6(35.29%)

* Male to female ratio was 1.4:1, 1:1, and 1.8:1 in POAG, PACG and control groups respectively.

Table 3General Characteristics

	POAG (17 patients)	PACG (14 patients)	Controls (17 patients)	P value*
Age (years) Mean ± SD	60.29 ± 8.06	59.14±6.34	57.18± 5.75	0.412
IOP (mm Hg) Mean ± SD	15.52 ± 4.27	15.80 ± 2.62	14.82 ± 2.08	0.50
SBP(mm Hg) Mean ± SD	136.35± 8.22	135.71±14.09	136.82±11.024	0.962
DBP(mm Hg) Mean ± SD	85.82±5.22	85.85±8.28	86.58±5.64	0.927

Table 4 Blood Flow Parameters

		POAG	PACG	Controls
OA	PSV (cm/s)	22.81 ± 6.89	23.71 ± 3.30	25.85 ± 2.58
	EDV(cm/s)	6.03 ± 2.72	7.88 ± 1.35	10.89 ± 1.87
	RI	0.73 ± 0.07	0.66 ± 0.04	0.57 ± 0.06
CRA	PSV(cm/s)	11.11 ± 3.10	9.27 ± 2.35	12.87 ± 2.51
	EDV(cm/s)	3.33 ± 1.18	2.99 ± 0.95	5.74 ± 0.88
	RI	0.69 ± 0.08	0.69 ± 0.04	0.52 ± 0.05
SPCAs	PSV(cm/s)	9.84 ± 2.73	9.58 ± 1.85	11.60 ± 2.75
	EDV(cm/s)	3.05 ± 1.25	4.21 ± 1.25	6.58 ± 1.93
	RI	0.70 ± 0.07	0.56 ± 0.08	0.410.13)

Table 5Statistical Significance (p Values)*

		OA	CRA	SPCAs
POAG vs. Controls	PSV	0.018	0.01	0.01
	EDV	0.0001	0.0001	0.0001
	RI	0.0001	0.0001	0.0001
PACG vs. Controls	PSV	0.01	0.0001	0.003
	EDV	0.0001	0.0001	0.0001
	RI	0.0001	0.0001	0.0001
POAG vs. PACG	PSV	0.58	0.026	0.62
	EDV	0.006	0.278	0.002
	RI	0.0002	0.64	0.0001

*Unpaired t-test has been used for statistical analysis.

Cross-sectional study of computer vision syndrome among human resource professionals in tertiary care hospital

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Abstract

To detect the prevalence of computer vision syndrome among human resource professionals in tertiary care hospital. The dependence on the computer is rising with time. This will lead to numerous ill-effects in human beings out of which ocular manifestations play a prominent role. Previously done studies reveal that the awareness of ocular manifestation is less than 20%. Among the lesser known ocular manifestations, one of it is computer vision syndrome. This cross-sectional study included HR professionals of SRMS IMS, Questionnaire survey study data were collected in computer users regarding the demography, duration of computer use (hour per day), years of computer use, working distance from computer, level of top of screen from eye level, use of antiglare screen, brightness and contrast adjustment, taking breaks during computer use. During this study period, 60 patients were randomly selected from HR professionals. In which, 37 (62%) males and 23 (38%) females were participated. They were having ocular complaints in descending order such as eye strain (69%), headache (56%), dryness (49%), irritation (47%), burning sensation (41%), blurred vision (39%), itching (32%), watering (29%), redness (21%), and double vision (16%).

Key words : Computer vision syndrome, dry eye.

1. Introduction

Computer was invented by Charles Babbage in 1791, which was modified into a programmable computer by Manglebone in 1871.[1] In India first computer was used in Indian Statistical Institute in Calcutta in 1956.[1] INS survey was conducted in December 2013 which says total number of computer users in India was 150,000,000.[2] We cannot think the modern world without computers. The dependence on the computer is rising with time. This will lead to numerous disorders in human beings out of which ocular manifestations play a prominent role. Healthy eyes can easily maintain focus on the printed page. Characters on a computer screen however don't have this contrast or well-defined edges. These characters (pixels) are brightest at the center and diminished in intensity towards their edges. This makes it very diffi cult for our eyes to maintain focus and remain fixed on these images. Instead, our eyes drift out to a point called the "resting point of accommodation" that is approximately 30" and grows as we get older. When the demand at near work exceeds the normal ability of the eye to perform the job comfortably, one develops discomfort and prolonged exposure to the discomfort lead to a cascade of reactions that can be put together as Computer Vision Syndrome. American Optometric Association defines Computer vision syndrome (CVS) as "the complex of eye and vision problems experienced during or related to computer use."[3] National Institute of Occupational Safety and Health Survey has reported that visual symptoms occur in 75-90% as opposed to 22% musculoskeletal disorders of video display terminals (VDT) workers. CVS characterized by eye strain, eye tiredness, headache, blurred vision, dryness, irritation, redness, contact lens discomfort, neck shoulder, and back pain.[4-6]

2. Materials and Methods

This cross-sectional was conducted in Department of Ophthalmology, Shri Ram Murti Smarak Institute of Medical Sciences Bareilly India during the period of January 2016 to August 2016. The study design was approved by the Human Ethical Committee of SRMS IMS . Patients are taken randomly from HR profession who are all attending ophthalmology outpatient department. Patients between age 20 and 50 years who are Computer users with complaints of eye strain, dry eye, blurred vision, redness, watering, headache neck and shoulder pain and have minimum 1 h exposure to any type of VDT such as desktop, laptop or both for at least 2 years are included in the study. Computer users of age <20, >50, contact lens users, those who are on treatment for thyroid disorders or Suffering from ocular inflammatory conditions like conjunctivitis, scleritis, uveitis, glaucoma, stye and blepharitis and Patients having any fundus pathology like optic atrophy, Diabetic retinopathy, Hypertensive retinopathy, papilledema are excluded from the study. Need for the study was explained to the patients, and their consent was obtained. Questionnaire survey study data was collected from patients regarding the demography, ocular complaints such as eyestrain, eye tiredness, headache, blurred vision, irritation, redness, duration of computer use (hour per day), years of computer use, their refractive status, whether they were using glasses or not, working distance from computer, level of top of screen from eye level, use of antiglare screen, brightness and contrast adjustment, taking breaks during computer use.

3. Results

During this study period, 60 patients were randomly selected from HR professionals who visited department of ophthalmology of SRMS IMS Bareilly. In which 37 (62%) males and 23 (38%) females were participated. They were having ocular complaints in descending order like eye strain (69%), headache (56%), dryness (49%), irritation (47%), burning sensation (41%), blurred vision (39%), itching (32%), watering (29%), redness (21%), and double vision (16%). Most of them were working computers 7-9 h/day, and most of the males were working 16-20 years and females were working 11-15 years in our study [Tables 1 and 2].

Table 1 : Duration of computer usage in males and females.

Duration of computer use (h/day)	Male (%)	Female (%)
Upto 3 h	1(42.)	1(58.)
4-6 h	8(67.)	4(33.)
7-9 h	18(62.)	12(38.)
10-12 h	10(60.)	6(40.)
P=0.034 significant		
Duration of computer use (years)		
Upto 5 years	12(61.)	8(39.)
6-10 years	14(66.)	7(34.)
11-15 years	7(55.)	6(45.)
16-20 years	4(66.)	2(34.)
P=0.045 significant		

Table 2 : The gender distribution based upon distance and level of the top of screen.

Duration of computer (inches)	Male (%)	Female (%)
10-15	8 (62.3)	6 (37.7)
16-20	12 (64.5)	6 (35.5)
21-25	14 (60)	9 (40)
26-30	3 (60.8)	2 (39.2)
P=0.028 significant		
Level of the top of screen		
Above the level of eyes	3 (69.5)	2 (30.5)
At the level of eyes	25 (57.6)	18 (42.4)
Below the level of eyes	9 (74.1)	3 (25.9)
P = 0.52 not significant		

Table 3 : The gender distribution based upon use of antiglare screen, brightness adjustment, taking breaks during computer us

Use of antiglare screen	Male (%)	Female (%)
Using screen	26 (43.3)	17 (29)
Not using screen	11 (56.7)	6 (71)
P=0.41 not significant		
Brightness adjustment Adjustment	30 (49)	14 (24)
No adjustment	7 (51)	9 (76)
P=0.34 not significant		
Breaks during computer use		
Took breaks	22 (37)	14 (24)
No breaks	15 (63)	9 (76)
P = 0.05 not significant		

Another study reported that the prevalence of the visual symptoms were significantly higher in the individuals who spent more than 4 h daily, working on VDT. The duration of the computer work was directly related to the eye symptoms, and that a longer duration tended to result in long-lasting complaints that persisted even after the VDT work was finished. Our study also revealed that the ocular complaints were reported more by the subjects who used computers for more than 6 h a day. Duration of computer use had significant relationship (P = 0.034). 36% males and 28% females were having refractive error that was corrected by spectacles [Tables 3]. Our study also found that the ocular complaints were more frequent in the subjects who did not use glasses and redness had a significant association. Most of them 23 (38%) were working in 21-25 inches working distance and they (72%) have a level of the top of the screen at the same level of eyes. Antiglare computer screen was used by 43% males and 29% females. Only 24% females had knowledge about computer brightness and contrast adjustment in our study.

4. Discussion

The prevalence of computer vision syndrome in our study was 97.4% of which eye strain was 69% that was correlates with Bali et al.2007.[7] The duration of computer use is directly related to eye symptoms, and longer duration tends to result in longlasting complaints even after the work was finished (Bergqvist and Knave, 1994; Sanchez-roman et al., 1996, Shimaet al., 1995). Stella et al., (2007) observed more pronounced visual symptoms in people spending 6-9 h daily at computer. A higher proportion of subjects who had their computer screen at or above the eye level reported more symptoms (Bhanderiet al., 2008; Jaschinskiet al., 1998; Bergqvist and Knave, 1994).[8-10] Tear film maintains moisture and oxygen balance of cornea. Blink reflex facilitates resurfacing of the precorneal tear film. Normal blinking rate is 12-15 times/min. It is 60% less than normal people while working with computer.[11] Other factors responsible for computer vision syndrome were poor workstation setup or improper use of work station, glare and reflections from the monitor and surroundings, uncorrected spectacle power Inappropriate glasses for computer use and Job nature and stress (Stella et al., 2007; Cole, 2003).[12,13] Computer vision syndrome can be managed with work style modifications like chair adjustment - chairs with armrests, position of head slightly tilted downwards and the feet rest flat on the floor. Use suspended lights from ceiling and shade windows with curtains. Attach an antiglare screen in front of the monitor, minimize glare on computer by turning monitor away from the window and reducing strong overhead light, balancing overhead and window light with a desk lamp (Sheedy et al., 2005). Use screen mounted document holder at the same plane

of the computer. Ideal viewing area of the monitor is 6 inches, below the horizontal eye level. Monitor should be more than 25 inches straight from eyes. Work with fonts of darker shades on the lighter background.[14] Avoid sitting in front of A.C or in a room with low humidity. Eye breaks during computer use by 20-20-20 rule as suggested. Take short breaks every 20 min for 20 s and look away 20 feet.[4-6] Even people with normal vision would need glasses just for computer use. They allow eyes to focus more clearly and reduce strain from monitor use. +0.25 D power is usually added in the glass to move out eye's focal point closer without using accommodation. Bifocal, progressive lenses also can help in reducing CVS (Sheedy, 2000).

Preservative free Artificial tears eye drops form the mainstay of management of dry eyes in CVS.[15]

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"STATE OF AWARENESS AND PERCEPTION ON EYE DONATION IN POPULATION OF NORTH INDIA"

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INTRODUCTION :

Corneal diseases are a significant cause of visual impairment and blindness in developing world. A shortage of transplantable corneas is common and has been subject of much attention.

AIMS AND OBJECTIVES :

- To assess the **awareness** on eye donation in population of a city and adjoining areas.
- To assess the **perception** on eye donation in population of a city and adjoining areas.

MATERIAL AND METHODS :

This is a **prospective cross-sectional study** including **urban** and **slum** area population and school going children (>15 years) in city and adjoining areas and were willing for study. A pretested, semi-structure **questionnaire** was provided for collecting the necessary information after obtaining informed consent in relation to **awareness** and **perception** on eye donation. A total of 3876 people were included in the study from January 1st to December 31st, 2016 and divided into 4 age groups (15 – 20), (21 – 40), (41 – 60), (>60).

RESULTS AND CONCLUSION :

A total of **3876** subjects were included in the study spanning across >15 to > 60 yrs. of age. The maximum no. of subject were in the young and middle aged age group, with 21 – 40 yrs. Comprising 32.04% and 41-60 yrs. Comprising 27.78% of the population studied 15-20 yrs. Subjects were 22.65% and >60 yrs. being 17.51% of total subjects included in the study. **Geographically**, urban population was almost double (64.21%) as compared to the slum / rural population (35.78%). This data also highlights the poorer access of slum / rural population to a medical / health professional as compared to the urban population. Complying with the **general sex ratio** of the country, **males 2117 (54.61%)** were more than the **female 1759 (45.38%)** subjects across all age groups and in both urban as well as slum / rural areas. (Table -1)

Regarding **awareness** of eye donation, the urban population **2489 (64.21%)** was marginally ahead of the slum population **1387 (35.78%)** with lesser margin in the 21-40 and 41-60 years age group. In age group 21-40 years urban population **677 (83.58%)** is more aware as compared to slum / rural population **335 (77.54%)**. This margin was however slightly more in the younger (15-20) and older (>60 yrs.) age group. **Mass media (TV/radio)** was the major source of awareness about eye donation across all age groups and in both slum / rural and urban population but maximum / significant in age group 41-60 yrs. Urban **537(78.16%)** slum **247(69.54%)**. **Organ donation camps** were also helpful in spreading awareness after

TV / radio. Although the younger (15-20 years) and elderly (>60 years) got to know about the eye donation programme through friends as well. Very young (15-20 years) and very old (>60 years) population seemed to have a lower degree of awareness as compared to the middle aged population. Regarding **willingness** for eye donation urban population was more willing **(~88-90%)** as compared to the slum / rural population **(~80%)** in urban population age group 41-60 years maximum willingness **622(90.53%)**, where as in slum more willingness in age group (>60years) **239(87.86%)**. This higlights the importance of spreading more awareness in slum population to enhance this percentage.(Table-2)

Regarding **religious restriction(~20%)** of urban population and **(~20-30%)** of slum population considered eye donation as against their religious beliefs ; as shown by the minority population of the country.Maximum subjects considered eye donation a **noble deed** urban and slum / rural alike as significant in age group 41-60 years urban **566 (82.38%)** and slum **303 (76.90%)**. However the percentage of subjects who considered it **disfigurement** were more in slum population **(~9-19%)** than urban population **(~6-12%)**.Most of the people know that the **hospital or society** was to be **approached after death** for eye donation but maximum in younger age group 21-40 years urban **691 (85.30%)**, as well as rural **312(72.22%)**.The greatest myth about eye donation which was seen in both urban and slum population is used for transplantation. This no. was more in slum **(~64-72%)** slum than urban **(~61-70%)** population mostly in slum population between age group 21-40 years **307(71.06%)**. (Table-3)

Table 1. - Age group, Urban or Slum, Male /Female

Sl. No.	Age Group	Total (3876)	Urban (Male + Female = 2489)	Slum (Male + Female = 1387)
1.	15 – 20	878 (22.65%)	Male – 314 (53.67%) Female – 271 (46.01%) Total – 585	Male – 151 (52.24%) Female – 138 (47.75%) **Total – 289**
2.	21 – 40	1242 (32.04%)	Male – 458 (56.54%) Female – 352 (43.45%) **Total – 810**	Male – 228 (52.77%) Female – 204 (47.22%) **Total – 432**
3	41 – 60	1077 (27.78%)	Male – 395 (57.49%) Female – 292 (42.50%) **Total – 687**	***Male – 214 (54.31%)*** Female – 180 (45.68%) **Total – 394**
4	> 60	679 (17.51%)	Male – 216 (53.07%) Female – 191 (46.92%) **Total – 407**	Male – 141 (51.83%) Female – 131 (48.16%) **Total – 272**

Table 2 . - Awareness

Sl. No.	Age group	KNOWLEDGE				WILLING				HOW DO YOU KNOW		
		Urban		Slum		Urban		Slum			Urban	Slum
		Yes	No	Yes	No	Yes	No	Yes	No			
1.	15 - 20	459 (78.03%)	130 (22.07%)	193 (66.78%)	96 (33.21%)	512 (87.08%)	77 (13.07%)	206 (71.28%)	83 (28.71%)	a. Mass media (TV/Radio)	404 (68.62%)	153 (52.94%)
										b. Friends	128 (21.73%)	71 (24.56%)
										c. Organ donation Camps	30 (5.09%)	23 (7.95%)
										d. Don't Know	27 (4.58%)	42 (14.53%)
2.	21 -40	**677 (83.58%)**	133 (16.41%)	**335 (77.54%)**	97 (22.45%)	712 (87.90%)	98 (12.09%)	346 (80.09%)	86 (19.90%)	a. Mass media (TV/Radio)	591 (72.96%)	274 (63.42%)
										b. Friends	110 (13.58%)	93 (21.52%)
										c. Organ donation Camps	68 (8.39%)	26 (6.01%)
										d. Don't Know	41 (5.06%)	39 (9.02%)
3.	[illegible]	543 (79.03%)	144 (20.96%)	292 (74.11%)	102 (25.88%)	**622 (90.53%)**	65 (9.46%)	312 (79.18%)	82 (20.81%)	a. Mass media (TV/Radio)	**537 (78.16%)**	**247 (69.54%)**
										b. Friends	57 (8.29%)	62 (15.97%)
										c. Organ donation Camps	54 (7.86%)	32 (8.12)
										d. Don't Know	39 (5.67%)	26 (6.29%)
4.	>60	310 (76.16%)	97 (23.83%)	180 (66.17%)	92 (33.82%)	355 (87.22%)	52 (12.77%)	**239 (87.86%)**	33 (12.13%)	a. Mass media (TV/Radio)	292 (71.74%)	183 (67.27%)
										b. Friends	63 (15.47%)	31 (11.39%)
										c. Organ donation Camps	18 (4.42%)	9 (3.30%)
										d. Don't Know	34 (8.35%)	49 (18.01%)

										d. Don't Know	(8.35%)	(18.01%)		

Table - 3: Perception

Sl. No.	Age Group	RELIGIOUS RESTRICTION				AFTER DEATH			WHOM YOU APPROACH			WHICH PART OF EYE		
		Urban		Slum			Urban	Slum		Urban	Slum		Urban	Slum
		Yes	No	Yes	No	a. Disfigurement	47 (7.97%)	53 (18.33%)	a. Friends	48 (8.14%)	44 (15.22%)	a. Whole Eye	364 (61.79%)	187 (64.70%)
1.	15 - 20	84 (14.26%)	505 (85.73%)	69 (23.87%)	220 (76.12%)	b. Sells by Doctor	52 (8.82%)	48 (16.60%)	b. Hospital or Society	460 (78.09%)	175 (60.55%)	b. Cornea	103 (17.48%)	28 (9.68%)
						c. Noble Work	469 (79.62%)	155 (53.63%)	c. Family members	51 (8.65%)	49 (16.95%)	c. Cornea & Sclera	65 (11.03%)	34 (11.76%)
						d. Not Interested	21 (3.56%)	33 (11.41%)	d. Don't Know	30 (5.09%)	21 (7.26%)	d. Don't Know	57 (9.67%)	40 (13.84%)
2.	21 -40	155 (19.13%)	655 (80.86%)	112 (25.92%)	320 (74.07%)	a. Disfigurement	63 (7.77%)	42 (9.72%)	a. Friends	43 (5.30%)	47 (10.87%)	a. Whole Eye	**560 (69.13%)**	**307 (71.06%)**
						b. Sells by Doctor	45 (5.55%)	27 (6.25%)	b. Hospital or Society	**691 (85.30%)**	**312 (72.22%)**	b. Cornea	103 (12.71%)	35 (8.10%)
						c. Noble Work	651 (80.37%)	350 (76.15%)	c. Family members	59 (7.28%)	46 (5.67%)	c. Cornea & Sclera	91 (11.23%)	57 (13.19%)
						d. Not Interested	51 (6.29%)	34 (7.87%)	d. Don't Know	17 (2.09%)	27 (6.25%)	d. Don't Know	56 (6.91%)	33 (7.63%)
3.	41 - 60	141 (20.52%)	546 (79.47%)	118 (29.94%)	276 (70.05%)	a. Disfigurement	48 (6.98%)	36 (9.13%)	a. Friends	96 (13.97%)	42 (8.12%)	a. Whole Eye	461 (67.10%)	276 (70.05%)
						b. Sells by Doctor	57 (8.29%)	37 (9.39%)	b. Hospital or Society	496 (72.19%)	278 (70.55%)	b. Cornea	64 (9.31%)	49 (12.43%)
						c. Noble Work	**566 (82.38%)**	**303 (76.90%)**	c. Family members	63 (9.17%)	58 (14.72%)	c. Cornea & Sclera	89 (12.95%)	17 (4.31%)
						d. Not Interested	16 (2.32%)	18 (4.56%)	d. Don't Know	32 (4.65%)	26 (6.59%)	d. Don't Know	73 (10.62%)	52 (13.19%)
4.	>60	58 (14.25%)	349 (85.74%)	70 (17.19%)	202 (74.26%)	a. Disfigurement	47 (11.54%)	34 (12.50%)	a. Friends	37 (9.09%)	23 (8.45%)	a. Whole Eye	251 (61.67%)	188 (69.11%)
						b. Sells by Doctor	28 (6.87%)	17 (6.25%)	b. Hospital or Society	277 (68.05%)	174 (63.97%)	b. Cornea	29 (7.12%)	17 (6.25%)
						c. Noble Work	318 (78.23%)	199 (73.16%)	c. Family members	66 (16.21%)	42 (15.44%)	c. Cornea & Sclera	51 (12.53%)	10 (3.67%)
						d. Not Interested	14 (3.43%)	22 (8.08%)	d. Don't Know	27 (6.63%)	33 (12.13%)	d. Don't Know	76 (18.67%)	57 (20.95%)

DISCUSSION :

This study aims to find out the awareness and perception on eye donation in a city of North India. A **total 3800 people** were studied including both urban and slum population conducted over a period of one year from **January 2016 to December 2016** aged **>15 years**.

In this study it was found that **males (~ 53%)** were more aware than **female (~ 44 – 48%)** because males were more exposed to outer environment and interested more in recent or social activities. **Dandona[1] et al (1999)** assessed in urban population of Hyderabad, India reports **males (~53.3%)** were aware. **Ronanki[8] V.R.et al(2014)**among stakeholders in Srikakulum district in South India, 355 subjectsof the subjects interviewed **(54%) males** were more aware than **females (46%)**.**Gupta Aruna[6](2015)** found that **(56%)males** were more aware than **females (34%)** about eye donation. **Gupta Anita[6] et al (2009)** reported that students of Nursing College Bangalore aged 18 to 21 years, 188 students in a duration of 6 months **males (~56.4%), females (~43.6%)** were aware.

In our study **awareness** was more in **urban(83.58%)** than **slums(79.18%)** probably because of literacy. They were more aware about **whom to approach** (Society of Hospital) in **urban (85.13%)** and **slum (72.22%). Willingness** to donate eye was more in **urban** population **(90.53%). Dandona[1] et al (1999)** assessed in urban population of Hyderabad, India awareness of eye donation was **(73.8%)** but only **(44.9%)** were willing to pledge eyes. A total of 2522 subjects aged > 15years. **Priyadarshani B[2].et al (2003)** in adult population of Southern India, 507 participants chosen by systemic, random sampling out of which **(50.69%)** were aware between age**35 – 80** years from urban areas. **Krishnaiah[3] S.et al (2004)** in a rural population of Andhra Pradesh Southern India, **7775** subjects of all ages observed **(30.7%)** were and **(32.9%)** were willing to pledge eye. **Bharti M.K.[5]et al (2009)** among university students Kualalampur Malaysia out of 400 students **(77.1%)** were aware and **(27%)** were willing to donate their eye. **KaurManpreet[10](2015)** reports that out of 400 medical students **(77%)** aware about eye donation and **(51%)** of them were willing to donate their eyes. **Gupta[9] et al (2015)** quoted that medical students in Western India majority **(87%)** were willing to donate their eyes.

Studies which **not supports or variate** from our study: **Singh M[4].M.et al (2007)** in 1st year medical students of M.M.C. Delhi, 180 students participate, age between **18 – 21 year** observed **(99.4%)** were aware and majority**(87.2%)** were willing to donate eyes. **Gupta Anita[6] et al (2009)** assess in 1st and 2nd year (188) nursing students majority **(96.8%)** were aware for donating eyes and **(85.1%)** were willing. **Mishra Pankaj[7] et al (2012)** analyzed in nursing students of Dehradun majority of **(95.6%)** knew that eyes can be donated after death and mostly **(82.5%)** were willing or had already donated their eyes. **Ronanki V[8]. R.et al (2014)** among stakeholders in Srikakulum district in South India, 355 subjects were interviewed, found that awareness regarding eye donation among stakeholders was **(93%)** and the willingness to donate eyes was **(82%)** among them.

Overall the preferential knowledge gained was from **mass media** (T.V./ radio) **(78.16%)** in comparison to other modes like or followed by friends **(~ 8 – 22%),** organ donation camps **(~4-9%)** and **(~4 – 9%)** were don't know. **Dandona[1] et al (1999)** found source of information for awareness of eye donation was **mass media (83.3%). Priyadarshani B[2]. (2003)** The major source of awareness was publicity campaigns **(40.86%)**. Major proportion of the current awareness of eye donation has through publicity campaigns runs by various N.G.Os. and other voluntary organization supplemented by media campaigns by the government

agencies, probably not effective illiterate population.**Singh M.M**[4]**. et al (2004)** reports **(79.2%) mass media** comprise the major source of information about eye donation. **Singh M.M**[4]**.et al (2007)** showed **TV (Mass media)** was the most common source of information on eye donation **(77.8%)** followed by news paper**(72.8%)** and magazines **(54.4%)** of 180 students M.M.C., Delhi.

Bharti M.K[5]**.et al (2009)** reports **(76.69%)** utilization of the mass media to increase coverage of eye care education and eye donation campaigns will also help to increase the frequency of eye donation. **Ronanki V.R**[8]**. et al (2014)** suggests that major source of information on eye donation was the mass media **(61%)** approx. all the stakeholders followed by information through the eye care professional working in the area with **(24%). KaurManpreet**[10] **et al (2015)** regarding various aspects of eye donation TV or media were the most important channel of getting information for majority **(60%)** of the students.**Gupta Arua**[9] **et al (2015) (~70%)** T.V. was the most common source of information on eye donation followed by **(13%)** doctors was the source of information. **Gupta Anita**[9] **et al (2009)** T.V. was the most common source of information on eye donation **(77.1%)** followed by newspaper **(72.8%)** and magazines **(50%).Krishnaiah. S**[3]**. et al (2004)** the source of information for awareness on eye donation was the mass media **(79.2%)** and others **(19%).**

Study which **not support us :Mishra Pankaj**[7] **et al (2012)** reveals that mass media was the most common source of information on eye donation **(92.5%)** followed by newspaper for **(55.83%)** and magazines **(30%).**

In our study **perception** about **eye donation as nobility / noble work (82.38%)** was more in urban than slum **(76.90%).Singh M.M. et al (2007)** nobility in the act of eye donation was the main motivational force according to **(85.5%)** of 180 students.**Gupta Anita**[9] **et al (2009)** nobility in the act of eye donation was the main motivational force according to **(85.6%)** of 188 students. **Mishra Pankaj**[7] **et al (2012)** perceived reason for donating eyes was nobility in the act of eye donation was the main motivational force according to **(82.6%).** Other major reasons were pleasure to help the blind **(70.9%)** and donated eyes can give vision to a person **(56.8%).KaurManpreet**[10] **et al (2015)**regarding perceived promoting factor for eye donation by them noble cause **(57%),** pleasure to help the blind **(51%).**

Greatest myth that **whole eye** is used for transplantation was more in slum **(~64 – 72%)** than urban **(~61 – 70%). Bharti, M.K**[5]**.et al (2008) (67%)** population think that whole eye is used for transplantation.**Gupta Aruna**[6] **et al (2015)** reported **32%** had the idea that whole eye is used for transplantation.

We also looked at the association of **various factors** for willingness to donate eyes as table – 6 shows **religious factors** where urban shows **(~14 – 21%)** and slum population **(17-30%)** but there is no such significant difference.

CONCLUSION :

As from above results it is found that slum area population is less aware of eye donation as compared to Urban population so more efforts should be made to make them aware regarding eye donation which will results in changing their perception for eye donation.

FINENTIAL DISCLOSURE:

No financial issue.

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Pediatric Corneal Transplant Surgery: Challenges for Successful Outcome

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Current Concepts in Pediatric Corneal Transplant Surgery

Visual rehabilitation of pediatric corneal blinds is a major challenge to corneal transplant surgeons. Penetrating keratoplasty is the only way to restore vision and prevent irreversible blindness due to amblyopia. Performing penetrating corneal grafts in children poses difficulty in evaluation, technical difficulties during surgery and problems during follow-up. Younger children do not cooperate for proper slit-lamp examination and need to be examined under general anaesthesia. In addition, corneal surgeon encounters problems of intraoperative positive pressure and difficulty in suturing during corneal transplant surgery. During follow up, allograft rejection, post penetrating keratoplasty astigmatism and post penetrating keratoplasty glaucoma are more frequent in pediatric group as compared to adult recipients. In case the graft is successful, the child requires rigorous treatment for amblyopia. Parents need to be counseled before surgery regarding possible visual outcome and chances of obtaining clear graft.

Indications of Penetrating Keratoplasty

Indications of penetrating keratoplasty may be grouped into congenital corneal opacities and acquired corneal opacities. Among the congenital causes Peter□s anomaly, congenital hereditary endothelial dystrophy(CHED), posterior polymorphous dystrophy, sclerocornea, dermoid and mucopolysaccharidosis are common indications for performing surgery (Fig.1).

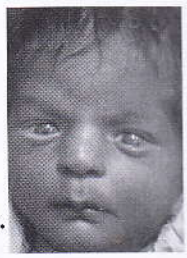

Fig 1. Bilateral congenital corneal opacity.

Fig 2.Bilateral acquired corneal opacities.

1, 2 Of the acquired causes traumatic corneal opacities, infectious keratitis, keratoconus, post cataract surgery corneal edema, non-penetrating corneal edema, are the main indications.1 Corneal edema due to endothelial cell decompensation in patients with buphthalmos has been successfully treated by penetrating keratoplasty.3 In cases of traumatic corneal scars the visual outcome depends upon the extent of injury to the posterior segment. The occurrence of indirect optic nerve injury, choroidal rupture and retinal detachment may limit the visual outcome after penetrating keratoplasty. In developing countries corneal opacities resulting from healed infective keratitis (bacterial, viral and fungal) constitute a major group of indications among the acquired causes (Fig.2).

4 Corneal opacities following keratomalacia is another frequent indication in developing countries (Fig.3).

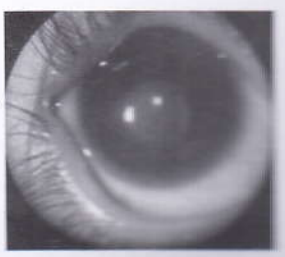

Fig 3.Unilateral acquired corneal opacity.

5 Congenital corneal opacities are usually bilateral, where as acquired corneal opacities are mostly unilateral.

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Age at the time of Penetrating Keratoplasty

Recent studies have shown that penetrating keratoplasty in children should be performed at the earliest to prevent irreversible amblyopia. In neonates with congenital corneal opacities, penetrating keratoplasty is advocated as soon as the child is fit for general anaesthesia. In case of acquired corneal opacities the waiting period for penetrating keratoplasty should be minimized. In case the waiting list for penetrating keratoplasty is long, the child is given priority over the adults. Penetrating keratoplasty in neonates and very young children is technically difficult and the risk of graft failure is high. In a study children having undergone unilateral cataract surgery before the age of four months had better visual outcome as compared to those after four months. The study indicates that penetrating keratoplasty in children should be performed early to have better visual outcome. The youngest neonate reported to have undergone successful penetrating keratoplasty for large corneal perforation is, a 34 week post conception infant weighing 1 lb.

Neonates due to immunological immaturity are less predisposed to graft rejection. The immune system in neonates develops very early in gestation and is fully developed by birth. Neonatal immune system has characteristically dominance of T suppressor cells and qualitatively less functional B cells. It has been well documented that the anterior chamber is a privileged site for transplantation. This is mainly due to the absence of blood vessels in the cornea and non access to lymphatic system. This makes antigen presentation, which is the part of the afferent limb of rejection, ineffective. Clinical studies have also shown that in neonates with isolated corneal opacities, corneal transplantation in the neonatal period resulted in better prognosis in terms of both graft clarity and vision improvement.6 The success of these grafts has been attributed to both neonatal immune tolerance and clear visual axis during the most initial period of visual development. However, at 6 months of age, the immune system is fully developed and hyperactive and corneal grafts performed at that age are at higher risk for graft rejection.

It is widely accepted that the penetrating graft in a child should be performed at the earliest. But how early it should be, remain a question unanswered. Neonates with unilateral corneal opacity may be undertaken for penetrating keratoplasty at 2 months of age. While neonates with bilateral corneal opacities, the first eye may be operated at 10 to 12 weeks of age and the second eye may be taken 6 to 8 weeks later. Contrary to the conventional rule in adults, according to which we usually operate the eye with poor vision first, in neonates if bilateral surgery is required we operate eye with better potential first. This is done to decrease the chances of developing amblyopia in the better eye.

Evaluation of Infants or Neonates with Congenital Corneal Opacities

Detailed examination of infants and neonates with congenital corneal opacities is essential to plan treatment. The visual acuity must be ascertained. Response to light stimulus, fixation at light source and following of the movement of illuminated object or light source are helpful. Responses are to be observed carefully and even parents should be demonstrated these tests. Detailed personal history, obstetric history and family history in a child with congenital corneal opacity is recorded. Detailed ocular examination may not be possible in the consultation chamber as the neonates and infants will never be steady and fixate to allow detailed slit lamp bio-microscopy. This part of the examination is better performed under general anesthesia. The amount of information we get on detailed examination under general anaesthesia helps us in decision making. Under general anaesthesia, the detailed anterior segment examination, measurements of corneal diameters (both horizontal and vertical) and intraocular pressure readings are recorded. Details of corneal opacity, whether central or peripheral, localized or diffuse, are recorded. Peripheral corneal opacities occur in partial sclerocornea and peripheral corneal ulcers. Central corneal scars may occur in Peter□s anomaly. Perforated corneal ulcer may require therapeutic penetrating graft. Direct and indirect

ophthalmoscopy to visualize retina is performed details of retina, macula and disc are recorded.

Investigations

Ultrasonography, A scan and B scan are performed to evaluate vitreous and retina status. In case eye is microphthalmic there is always possibility of associated ocular anomalies. The ultrasound biomicroscopy (UBM) gives more details of intra ocular pathologies. UBM is of special importance in patients with corneal opacity and associated glaucoma. Configuration of anterior chamber angle, details of angle structures and ciliary body are better delineated by UBM. In patients with anterior staphyloma, UBM may provide correct position of the iris and details of iris incarceration or iris adhesions. UBM has been of immense value on studying the structural alterations in pathological conditions including sclerocornea, Peter□s anomaly, aniridia and ocular trauma. The status of lens and the integrity of the posterior capsule should be evaluated. In case the cataract is present, an additional surgical procedure of cataract extraction and post chamber IOL implantation along with penetrating keratoplasty should be planed.

Pediatric Keratoplasty Constraints

Pediatric penetrating keratoplasty poses a challenge to corneal surgeons. The major constraints to perform corneal transplants in neonates include technical difficulties due to small eyes and positive posterior pressure during surgery. In severe cases of sclerocornea ,the distinction between the sclera, limbus and cornea is obliterated and decision on the size of graft and centration becomes difficult. Low scleral rigidity cause extreme positive posterior pressure, resulting in a forward bulge of iris lens diaphragm that makes the surgery difficult.7 At times the positive pressure is extremely high and may cause extrusion of lens and loss of vitreous. Associated ocular abnormalities i.e. cataract, glaucoma and microphthalmia make the surgical procedure complicated and increase the operating time significantly. In the immediate post operative period severe inflammation is observed. Post surgery evaluation is difficult and most of the times, examination under general anaesthesia is needed. In case the surgery is delayed, immaturity of the visual system leads to amblyopia.

Preparation before Corneal Transplant Surgery

The aim of corneal surgeons is to attain a clear visual axis and prevent amblyopia by performing corneal transplant at an early age. Corneal transplants may be performed as soon as the child is fit for general anaesthesia. Corneal opacification should not be considered in isolation. There is always a possibility of associated eyelid and adnexal abnormalities. These abnormalities should be first corrected so that the graft surface following surgery is well protected and the integrity is not affected. Raised intraocular pressure should be controlled and brought to normal range either with medical treatment or surgical (glaucoma filtering surgery) intervention. Associated posterior segment anomalies, including retinal detachment or vitreous hemorrhage should be evaluated and treated. Child should be examined by a pediatrician before surgery and cleared for surgery under general anaesthesia.

Donor Tissue

Exact age matching between the donor and the recipient may not be possible, however excellent grades of tissue from younger donor should be used. Donor□s age between 4 to 30 years is best suited for children. Donor corneas from younger than 4 years are relatively difficult to handle during surgery and subsequently. Donor cornea from infants and very young children have steeper cornea and may result increase corneal curvature of the graft.8, 9 Unusually high myopia (60 D) has been reported from steeper donor cornea from young donors. This makes amblyopia treatment difficult. The donor cornea for corneal transplants in children should have endothelial cell count close to 3000.

Surgery

Extremely high positive posterior pressure is a major intro-operative problem encountered during corneal transplant surgery in Infants and neonates. Although it is impossible to eliminate the positive posterior pressure, however every effort should be made to keep it minimum. Digital pressure or application of Honan□s balloon is another good option to keep posterior pressure down. External pressure on the globe due to speculum should be avoided. Flieringa□s ring should be applied in every case. In case of smaller palpebral aperture lateral canthotomy reduces posterior pressure. Use of pre-op mitotic drops or intra cameral miotic may be useful to keep iris lens diaphragm behind. An experienced anaesthetist may be asked to keep the neonate at deeper plane of anaesthesia. A non depolarising muscle relaxant (NDMR) reduces the risk of movement and contraction of extraocular muscle. Keeping head at a higher level than feet (15 degree anti-Trendelenburg position) may be helpful. Anaesthetist may be requested to hyperventilate the child in case posterior pressure is extreme. Hyperventilation decreases posterior pressure and vitreous pressure by reducing the central venous pressure and choroidal venous blood volume.

A pre placed mattress suture is helpful in securing the graft immediately and pushing the iris lens diaphragm behind by injecting visco elastic substance.10 The number of mattress sutures used may be 1 or 2 depending upon the requirement. These sutures if needed can also be applied after trephination of host cornea. Use of 8 □0□ silk or monofilament to place cardinal sutures in case of extreme positive pressure is another good option. It secures the graft and one can inject viscoelastic substance to push iris lens diaphragm back. A cohesive viscoelastic substance i.e. healon GV or healon 5 may be used to keep positive posterior pressure down and allow suturing.

Surgical procedure should be completed in a shortest possible time. After punching the donor tissue all the instruments required for recipient trephination and donor button suturing should be kept ready. Neonates or infants may be given intravenous mannitol 20% (0.5 to 1.5 gm / KBW) to reduce the vitreous volume and thus decreasing the positive posterior pressure. At times the positive posterior pressure is extremely high and it may not be possible to suture the graft unless we reduce it. Some of the surgeons have advocated placement of flat instrument (lens spatula) over the iris to prevent lens extrusion and vitreous loss. We routinely leave the recipient corneal button attached at 3 □0□ clock position and do not excise it completely. We place donor button in the recipient opening and start suturing. After securing donor corneal button with 4 cardinal sutures we excise the host corneal button and continue suturing. This intact recipient corneal button in situation of extreme positive posterior pressure is put back on the recipient open. Few more cardinal sutures are applied and posterior pressure is reduced. Then the donor button is sutured. We have found this simple method extremely useful in combating high posterior pressure (Nirankari and Sharma, unpublished data).11 In case positive pressure is extreme and passing of 10 □0□ nylon is difficult and it is not holding, it is wise to use 8 □0□ nylon / silk suture and replace these sutures after the suturing in complete. Pars plana vitrectomy before trephination has been advocated to prevent posterior pressure for patients who are at higher risk for developing extreme positive posterior pressure during penetrating keratoplasty.

Size of the Graft

In a large multicentric study the average graft size was 7.1 mm diameter. Graft size may be determined according to the diameter of the cornea. For a normal sized cornea (10.5 mm) 7.5 mm diameter graft should suffice. However in case of Micro-ophthalmia/Microcornea graft size may be decreased according to the diameter of the cornea. Placing a normal sized graft (7.5 mm) in these eyes brings host graft junction very close to the limbus. This may predispose the graft to allograft rejection and its failure. Use of

small diameter grafts in otherwise normal cornea may have several disadvantages. This may result in higher astigmatism. With the use of small grafts the number of viable endothelial cells decreases significantly. In case the graft size is reduced from the size 8 mm to 6 mm diameter the number of viable endothelial cells on the graft decreases by 44%. Thus smaller grafts will be predisposed to graft failure as the redistribution of endothelial cells will result in further lowering to final cell count well below 1000 per mm2. It is advisable to use over sized donor corneal button (0.5 mm) routinely. In a study 1 mm over sizing for pediatric case has been advocated to decrease incidence of peripheral anterior synechia.12 This option should be used with extreme caution as this may cause difficulty in suturing of the donor button and in malaposition of the host-graft junction. In addition, if the donor happens to be young less than 2 years of age, the donor cornea is steeper and 1 mm over sizing will result in high myopia, and amblyopia therapy may be difficult.

Alternatives to Penetrating Keratoplasty

In children with corneal opacities partially obscuring the visual axis, gas permeable contact lens may be tried.13 Parents are usually apprehensive of gas permeable contact lenses. They should be adequatetly counseled and risk of developing amblyopia in absence of wearing rigid gas permeable contact lens should be explained. Majority of the patients suffering from opacities resulting from traumatic corneal lacerations can be managed by fitting rigid gas permeable contact lenses. (Fig 4.)

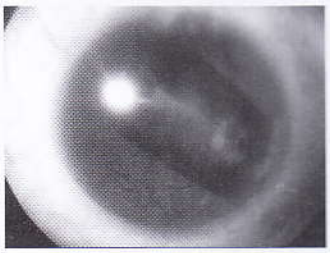


Fig 4.Healed corneal laceration for RG P contact lens fitting.

13 Some of the children are co-operative for fitting and monitoring during the follow-up. Children usually learn quickly how to insert or take out rigid gas permeable contact lenses. They take care of contact lenses as per directions.

In case opacification is central and peripheral cornea is clearer one can evaluate the child for auto rotational keratoplasty.14 The significant advantage is that the risk of allograft rejection is eliminated and chance of graft success is enhanced. However, post keratoplasty astigmatism and other problems of operating up on neonates / infant remain unchanged.

In case corneal opacity is central and larger part of the inferior cornea is clear, one can consider optical iridectomy.15 Optical iridectomy performed on the superior half of the iris does not serve any purpose as large part of it will be covered by the eyelids. Optical iridectomy is best performed in the lower nasal quadrant however one can opt for lower temporal in case opacity is extending into the lower nasal quadrant. In our experience patients are not happy with an optical iridectomy. Most of the times it does not provide an adequate vision to prevent amblyopia Infants and children with superficial corneal disease may be evaluated for superficial keratectomy. Most of the children suffering from pannus or conjunctivilization due to partial limbal stem cell deficiency can be treated with superficial keratectomy. Once a dissection plane is reached, it is extremely easy to remove the superficial corneal tissue. Children suffering from vernal ulcer and plaque formation need epithelial debridement and plaque removal in addition to medical treatment. The objective should be to achieve smooth and transparent corneal surface. To promote epithelization, bandage contact lens may be applied. Children suffering from chemical eye injury and having conjunctivilization due to partial limbal stem cell deficiency need superficial keratectomy with amniotic membrane transplant (Fig 5).

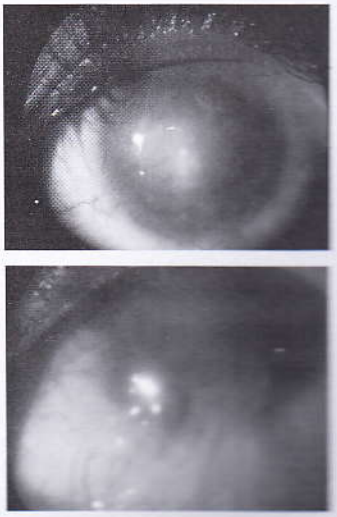


Fig 5.Chemical Eye Injury
Before amniotic membrane transplant
After amniotic membrane transplant

In case of partial thickness corneal opacities or in condition where endothelium is healthy, lamellar corneal surgery, lamellar keratoplasty or deep anterior lamellar keratoplasty may be advised. In case of superficial corneal opacities due to healed bacterial or fungal corneal ulcers one should consider lamellar keratoplasty. Corneal endothelium is healthy in these cases. Depending upon the depth of involvement of cornea one may chose to perform either lamellar keratoplasty or deep anterior lamellar keratoplasty.16

Advantage of DALK / LK are that all the intra-operative problems (extreme positive posterior pressure, danger of extrusion of lens and difficulties of suturing peripheral anterior synechia) may be avoided. In addition, risk of allograft rejection in DALK / LK is significantly less as compared to penetrating keratoplasty and post PK astigmatism is lower with visual rehabilitation being faster. These procedures may not be suitable for children with corneal opacities and deep corneal vascularization. Patient developing corneal opacities following recurrent herpes simplex keratitis are also a not suitable candidate either LK or DALK, as they may develop recurrence of HSK infection from residual corneal tissue. Cornea has been documented as site of viral latency and recurrence that may occur from corneal tissue alone. Limbal dermoids are best treated with LK / DALK depending upon the level of involvement (Fig 6).

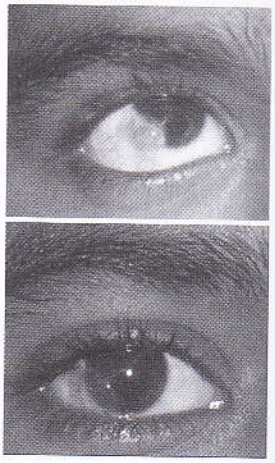


Fig 6.(a) Limbal dermoid pre-operative
(b) Limbal dermoid post surgery, DALK.

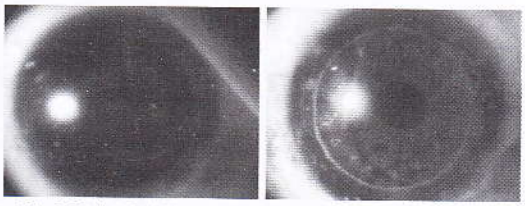


Fig 7.(a) DALK for multiple stromal foreign bodies (Pre op)
(b) DALK for multiple stromal foreign bodies (Post op)

17 We have treated a child suffering from corneal scaring due to multiple intrastromal foreign bodies in the right eye following cracker injury by performing DALK (Fig 7).

We have also treated corneal perforation with anterior staphyloma by performing DALK (Fig 8).

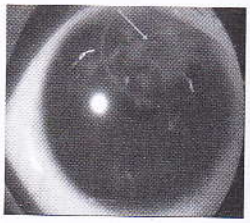


Fig 8.DALK for chronic corneal perforation with anterior staphyloma (Arrow corneal perforation)

High Risk Penetrating Keratoplasty

Presence of deep corneal vascularization in two quadrants or more predisposes the corneal grafts to higher risk of allograft rejection. Children having undergone penetrating keratoplasty for herpes simplex keratitis are at higher risk of graft rejection, recurrence of disease and failure. Children should be put on oral acyclovir prophylaxis. Children undergone regrafting are at higher risk of allograft rejection due to prior sensitization. Patients having corneal opacities in association with limbal stem cell deficiency and ocular surface disease are also at higher risk of developing graft failure due to allograft rejection. Children suffering from corneal opacification and associated ocular surface disease should undergo limbal stem cell transplant and amniotic membrane transplant prior to penetrating keratoplasty. Patients with severe ocular surface disease due to chemical eye injury, Steven□s Johnson Syndrome may undergo deep lamellar keratoplasty. Deep lamellar keratoplasty has a lower risk of allograft rejection.

Perioperative Care

Success of corneal transplant surgery in children is determined by meticulous peri-operative care. Thorough examination of child including slit lamp biomicroscopy should be performed. During the follow-

up visits parents should be explained danger signs and should be asked to report immediately as soon as the danger signs appear. The younger children and infants do not communicate their symptoms. However in case the child is irritable or crying without any obvious reason, he should be brought for eye check-up. The first examination is usually at 24 hours interval. Infants or children should be examined daily for one week and an alternate day for two weeks. After that once weekly examination is carried out. We examine the status of the graft clarity, wound integrity, epithelial healing, intraocular inflammation and intraocular pressure every visit. In case child develops any problem child may be examined early to the start treatment.

Complications:

Early

The common problems encountered in the first few days are disruption of host graft junction, fibrinous reaction, delayed epithelization and high intraocular pressure . Infective keratitis although rare (5%) may occur and needs intensive topical antibacterial treatment. Fibrinous exudative reaction should be treated with topical and systemic steroids. Delay in epithelization may be secondary to severe uveitis or high intraocular pressure. In these cases severe uveitis is treated with topical or systemic steroids. Once uveitis or high intraocular pressure is controlled epithelial defect heals completely. Rarely endophthalmitis following penetrating keratoplasty may occur.

Intermediate

Neonates and infants need to be examined under general anaesthesia at around 3 weeks even if they have no visible problem. Wound healing in neonates and infants is fast and sutures become loose. At 3 to 4 weeks loose suture should be removed. At 6-8 week complete healing occurs and sutures may be removed. Children aged between 2 to 4 years may be observed for loose suture. The loose suture should be removed immediately. Children above 6 years behave more or less similar to adults and selective suture removal should be performed.

Late Complications

Allograft rejection, suture related infections, recurrence of disease (HSK, keratoconus), post keratoplasty astigmatism and post keratoplasty glaucoma may occur. Suture related complications can be prevented by immediate removal of loose sutures. Loose suture may cause an epithelial defect, secondary inflammation, graft vascularization and trigger allograft rejection. Post keratoplasty astigmatism is higher with PKP as compare to lamellar procedure (LK/DALK). Selective suture removal can be done to reduce astigmatism in children aged 6 years of more.

Allograft Rejection

Parents should be explained that allograft rejection might occur any time after surgery. Studies have shown that 30% to 70% pediatric grafts fail within first six months and 65% to 85% within first year. Neonates and infants should be closely monitored for development of allograft rejection. Children are unable to complain about the symptoms and usually present late for treatment. Parents should be educated to bring the child for examination on observing any redness, discomfort, and opaqueness in the graft or decrease in vision. On every visit slit-lamp examination should be done to detect early signs of allograft rejection. Infants and children may not present with the characteristic signs of allograft rejection. Graft edema even in the absence of keratic precipitates should also be treated as allograft rejection. Intra ocular pressure should be monitored in these cases. Once allograft rejection is diagnosed, the child is put on prednisolone acetate (0.1%) eye drop every one hour and atropine ointment twice daily. In addition oral prednisolone (1 mg/kbw) should also be started. In recent studies topical cyclosporine A (2%) has been

found successful in treating graft reaction.18 It has also been used to prevent graft rejection in high risk cases. Cyclosporine A being lipid soluble, topical cyclosporine A (2%) need to be prepared in castor oil in the hospital pharmacy. At times young children may not tolerate it, as it causes significant ocular irritation. It has also been reported to cause persistent epithelial defects and delayed epithelial healing. Recent studies have shown that topical cyclosporine A prepared in the aqueous solution is also effective and can be prepared in preservative free artificial tear solution. Topical cyclosporine A 0.05% (Restasis, Allergan) has been found effective in treatment and prevention of graft rejection in high risk cases and reported to be equally effective in concentrations ranging from 0.05% to 1%.. The formulation of the of the drug is such that it releases large number of microdroplets in the tear film.

Glaucoma

Treatment of glaucoma prior to or after penetrating keratoplasty includes medical treatment, trabeculectomy with adjuvents and/or trabeculotomy. Treatment of refractory glaucoma is a real challenge as it will not only damage the optic nerve but also corneal graft resulting graft failure. Glaucoma drainage implant procedures have shown encouraging results in the treatment of refractory post penetrating keratoplasty glaucoma.19 Several authors have reported favorable results of pediatric penetrating keratoplasty following control of IOP using glaucoma drainage implant procedures. Although conventionally glaucoma is first controlled and only then is penetrating keratoplasty performed. At times due to the risk of development irreversible amblyopia glaucoma implant surgery may be combined with penetrating keratoplasty to provide early visual rehabilitation and preventing the development of amblyopia.

Treatment of Amblyopia

Amblyopia treatment should be started as early as possible following surgery. Cycloplegic refraction should be done and glasses should be prescribed. Parents should be explained that the normal eye of the child need to be patched so that he uses the operated eye. The schedule for patching may be the same as used for standard amblyopia treatment. In children upto 2 years (2:1), 2 to 3 years (3:1), 3 to 4 years (4:1), 4 to 5 years (5:1) and 6 years or above (6:1) should be used.

Outcome

Anatomical success rate following penetrating keratoplasty in childhood including infants and neonates has increased significantly. The incidence of vision restoration in children following penetrating keratoplasty is still low. Visual prognosis has been reported to be better in younger children and is likely determined by the incidence and severity of amblyopia. In recent study of 65 grafts on 58 eyes of 52 children (mean age 10.6 years SD 4.3 years) 38% achieved BCVA 6/9 or better and 60% had BCVA 6/18 or better.20 Visual acuity has been reported to be significantly better for the acquired indications as compared to the congenital ones. Significant numbers of patients in this study had keratoconus as an indication for penetrating keratoplasty (Fig 9). Results from developing countries are less favourable. In a study from India nearly 1/3rd patients achieved > or = 20/400 vision and nearly 50% of these achieved > or = 20/50.5 Allograft rejection, infective keratitis and glaucoma were major causes of graft failure. The overall long term (10 years) probability of maintaining clear graft after initial penetrating keratoplasty for Peter□s anomaly is 35% +/- 0.6%.21 Eyes with severe disease, larger donor cornea, co-existing central nervous system abnormalities and anterior synechia were reported to have significantly poorer outcome

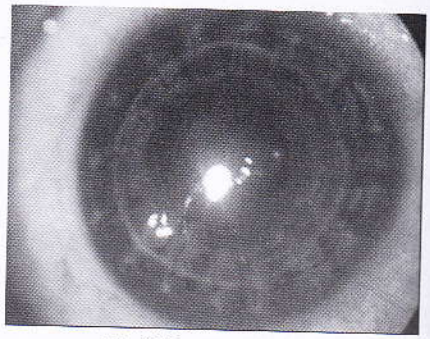


Fig 9.Penetrating keratoplasty for keratoconus.

than the eyes without these factors. Children with severe form of Peter□s anomaly may require multiple grafts to have functional vision. One of our patient with severe Peter□s anomaly had undergone four corneal transplants during 14 years and enjoyed good vision. He sadly died recently due to severe CNS disease (Fig 10).

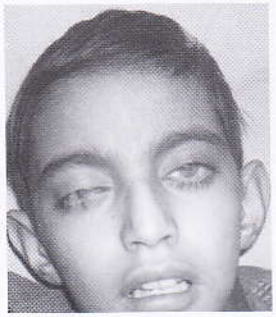


Fig 10.Regraft in a child with bilateral Peter□s anomaly (LE)

Repeat Corneal Graft

In case the child develops graft failure a repeat graft should be considered. In a recent study irreversible graft rejection has been reported as the commonest cause of graft failure.22 Patients need to be explained that subsequent corneal grafts have less chances of success. In one of the studies, of 27 repeat grafts undergoing second graft 19% were successful and of six graft undergoing third graft none succeeded. Repeat graft may be indicated to prevent dense and irreversible amblyopia. However in case the child is having unilateral corneal opacity, parents should be explained that even if the graft may becomes opaque, later on chances of improvement of vision by performing repeat graft will be there. In adults if the grafts fails due to the graft rejection, it is advisable to wait for 6 months before a repeat graft is performed. It is aimed to bring down the inflammation in the graft to minimum and to decrease the incidence of allograft rejection. At times it may be difficult to ascertain whether the graft failed due to allograft rejection or due to some other cause. It is better to treat it as allograft rejection. In younger children it may not be possible to wait for 6 months due to danger of development of amblyopia. In these cases the repeat graft may be performed at 3 months after the initial graft has failed. One can wait a little longer in case the child is six year old or more. Children suffering from perforated corneal ulcers need therapeutic penetrating keratoplasty and these grafts usually become opaque due to chronic inflammation. However, successful regraft can be performed for these patients at later date and both vision improvement and graft clarity can be obtained (Fig 11).

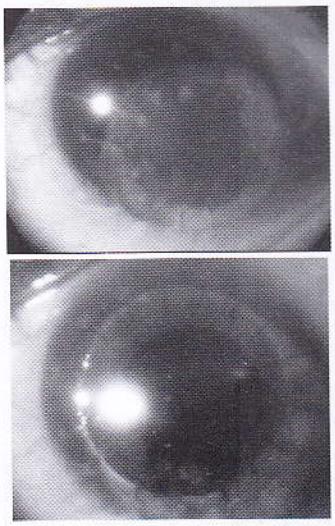


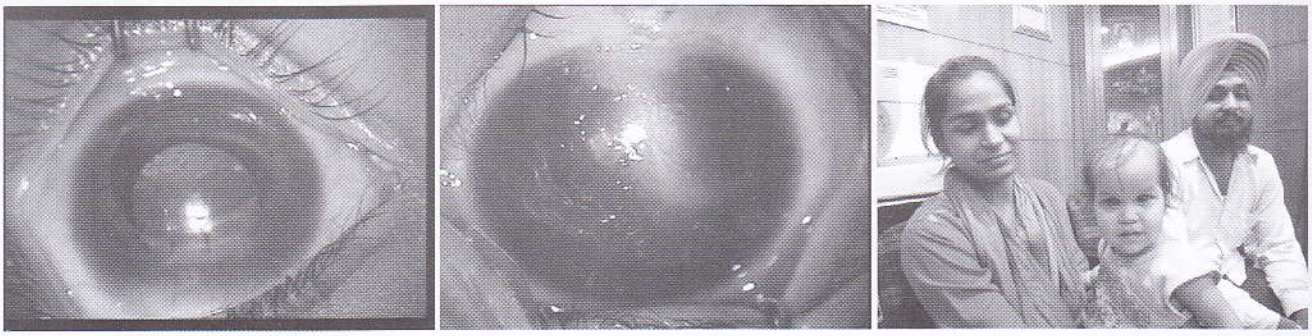
Fig 11.Regraft for opaque therapeutic graft
Before regraft
After regraft

Keratoprosthesis

Infants and children who are at high risk of graft rejection and subsequent graft failure may be benefited with keratoprosthesis or artificial corneal transplantation.23 Keratoprosthesis transplantation means placing an optical device in the host cornea. It is immunologically inert and has the advantage that graft rejection does not occur. Recently, a custom made Boston type 1 keratoprosthesis is available and can be designed to correct refractive errors including aphakia. AlphaCor, a synthetic cornea made up of hydrophilic polymer poly (2-hydroxyethyl methacrylate) is another keratoprosthesis used in high risk cases for corneal transplant surgery.24 The alphaCor is implanted in a corneal stromal lamellar pocket in a two stage procedure. In the first stage 3600 peritomy and debridement of corneal ephithelium is done. A superior 1800 limbal incision at 50% of depth is extended into the corneal stroma forming an intralamellar pocket is made. A central 3.5 mm posterior corneal trephination is performed. The device is placed with in the corneal pocket and paralimbal incision is closed. After 8 to 12 weeks anterior trephination (3mm) is done to expose the optic of the device. Keratoprosthesis helps the corneal surgeon to rehabilitate those corneal blinds having visual potential, but who are unlikely to be benefited by performing penetrating keratoplasty using human donor cornea.

Pediatric corneal transplant surgery is a team effort it involves combined effort of corneal surgeon

assisted by glaucoma specialist, pediatrician, anaesthetist, counselors and rehabilitation team(Fig 12 a,b,c). Rehabilitation of blinds due to corneal disease



Before PKP | After PKP | Child with bilateral PKP

Fig 12 Penetrating keratoplasty in a child with buphthalmos and opaque cornea

Children with bilateral corneal opacities either congenital, chemical burns, Stevens Johnson Syndrome may not be successfully visually rehabilitated even after performing repeated corneal grafts. The parents of these children should be counseled to get their children admitted to blind schools to provide educational and vocational training to these children. These children can lead independent life and contribute to the development of the society if proper facilities and opportunities are provided.

Summary & Conclusions

Advancement in micro-surgical techniques, quality eye banking and better anaesthesia facilities have made it possible to undertake corneal transplant in a neonate as soon as the diagnosis is made and corneal transplant surgery advised. Although surgery is technically demanding but it is possible to provide clear visual axis during critical period of visual development. Treatment and prevention of development of amblyopia in neonates is extremely important even after successful penetrating keratoplasty.

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Retropupillary Implantation of Iris Claw Lens to correct aphakia in the absence of capsular support

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Introduction

The ideal intraocular lens in cases of inadequate capsular support is still debated. Posterior chamber intraocular lens (IOL) implantation remains the ideal outcome following cataract extraction. However in Aphakia, posterior chamber IOL dislocation, Large posterior capsular rent or Whole bag removal, Marfan syndrome / ectopialentis, Large zonular dialysis, Traumatic dislocation of crystalline lens, there may be insufficient remaining capsular support for either intra capsular or posterior chamber sulcus placement of the IOL.The various IOLs available are 1) anterior chamber IOL (ACIOL), 2) scleral fixated IOL and 3) iris fixated IOL, both anterior and posterior.[1,2]

The first iris-claw IOL was introduced by Worst et al. in 1972[3],and a modification of this became the Artisan lens (Ophtec BV).(Fig 1a,1b)

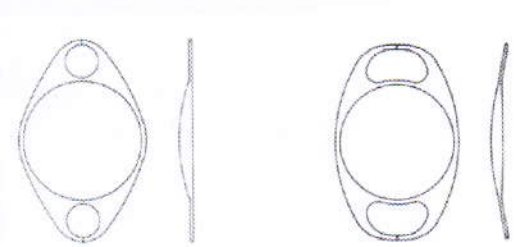

Fig. 1a

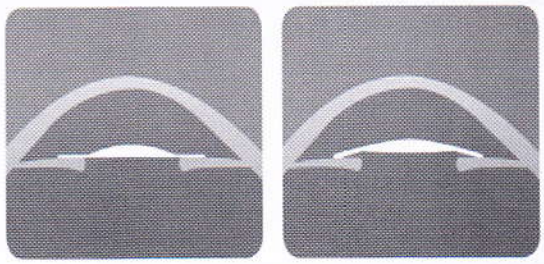

Fig. 1b

This IOL design incorporates a claw that is fixed to the immobile midperipheral portion of the iris; thus, it was suggested that the IOL did not disrupt the normal physiology of the iris or angle structures. The bridging arc of the IOL was also said to eliminate erosion of the pupil border, which occurs with traditional pupil-supported IOLs[4].It was suggested that the initial biconvex model increased the risk for pseudophakic bullous keratopathy (PBK). A modified convex–concave version was introduced in 1996 to increase the distance between the IOL and the corneal endothelium; this model has since been in common use. Subsequently, in 2005, the Verisyse iris-claw IOL (Abbott Medical Optics, Inc.) became available.

The technique of retro pupillary iris fixation of iris claw lens which was first reported by Andreas Mohr in 2002[5], offers several advantages. It combines the benefit of posterior chamber implants with a low-risk method of surgery and its cosmetic benefit, by hiding the IOL haptic and parts of the lens behind the iris , less surgical time and also preserves the anatomy of the anterior segment with respect to the position of the natural crystalline lens. Retropupillary fixation of iris-claw lenses enhances stability, prevents tilting of the lens and reduces the glare phenomenon, which is characteristic of the lens being implanted in the anterior chamber. There are also few disadvantages like disenclavation, pupillary deformity and iris atrophy.

Indications

Marfan syndrome/ectopialentis
Pre-op zonular dialysis
Traumatic dislocation of crystalline lens
Large zonular dialysis during surgery
Large posterior capsular rent
Whole bag removal
Posterior dislocation of IOL
As a secondary procedure in aphakia

Contraindications

Iris atrophy
Pseudoexfoliation
Large iridectomy, Sphincterotomy
Uveitis
Low corneal endothelial count

Investigations

BCVA with refraction
Slit lamp evaluation
Measuring intraocular pressure
Gonioscopy - to rule out anterior synechiae
Indirect ophthalmoscopy
Specular microscopy – to evaluate corneal endothelial cells count
OCT- to rule out retinal pathology

Surgical Procedure

Under general, sub-tenon, or topical anesthesia, superior or temporal, 5.5 mm sclera- corneal/clear corneal incision is made. Two paracentesis are made 90° from the main section. Intracameralpilocarpine is injected to constrict pupil. Iris claw IOL is introduced into the anterior chamber through main section. Viscoelastic (2% HPMC) is injected at each stage to deepen the anterior chamber and maintain space. Holding the optic with a lens forceps, one haptic is tilted down and pushed under the iris with gentle manipulation. Simultaneously a Sinskey hook is passed through the paracentesis on the same side. Once the haptic of the IOL is behind the iris,the haptic is tilted up to produce an indent on the iris. The iris is enclavated into the haptic claw with gentle push with theSinsky hook. Then with similar maneuver the other haptic enclavation isdone. Anterior or complete vitrectomy needs to be performed in most cases except those with a history of vitrectomy.Viscoelastic is aspirated with Simcoe's canula, anterior chamber is formed with Balanced Salt Solution and the conjunctiva is reposited.(Fig 2)

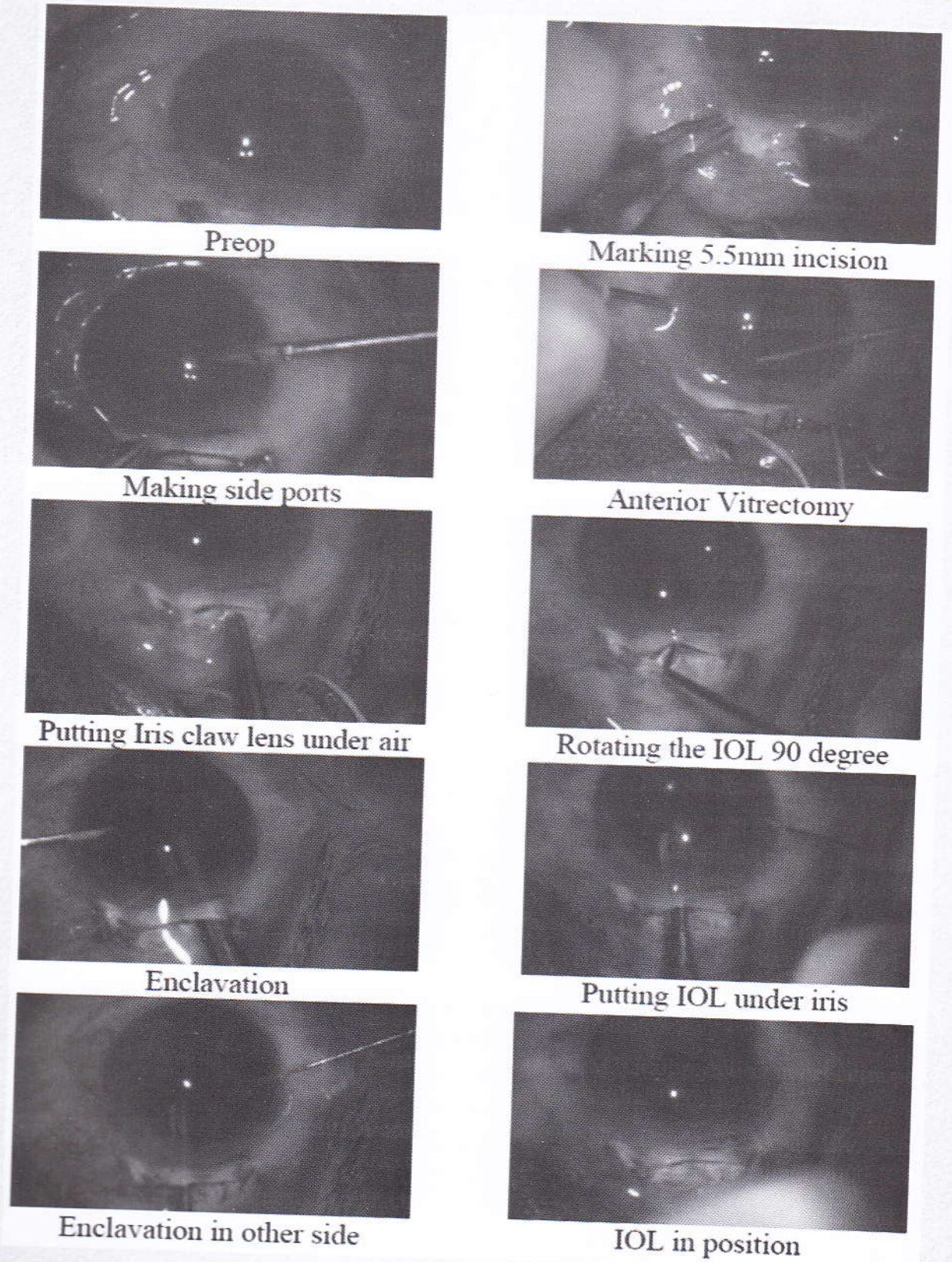

Fig.2. Steps of surgery

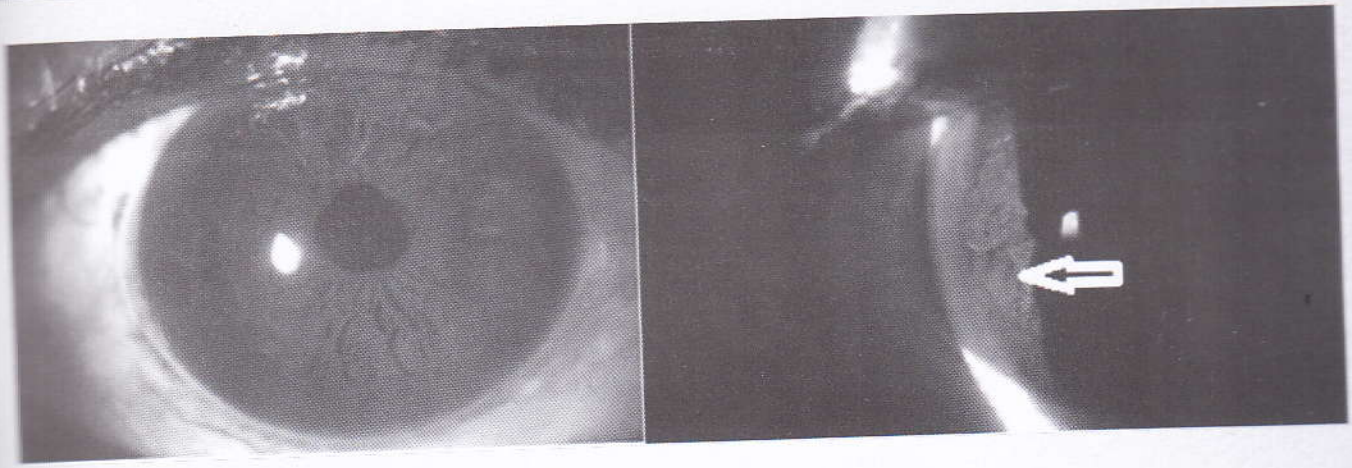

Fig.3 Post operative photo with site of enclavation (arrow)

Complications

Pupil ovalization
IOL dislocation
Elevated IOP
Pigment dispersion
Macular edema
IOL decentration
Corneal endothelial cell loss
Hyphema
Pupillary block
Chronic uveitis, TASS.

Advantages	Disadvantages
No suturing needed	Iris atrophy
Easy technique	Late dislocation of IOL
Less time required	Glaucoma
No tilting of IOL	Lens decentration
	Lens pigmentation

Discussion:

Several studies have advocated the use of iris-claw IOLs in patients with aphakia without capsular support in cases of good endothelial cell count, normal pupils and absence of contraindications[6,7,8]

Each of the available options has its own risks and complications: transscleral fixation of posterior chamber IOLs is an extremely technically demanding procedure with relatively high risk of intra-operative and post-operative complications and requires a large amount of dissection into the conjunctiva and the sclera[9,10].

Angle-supported anterior chamber IOL implantation, although technicallyeasier, has been associated with several complications related to the iridocorneal angle and the corneal endothelium[11]. Retropupillary implantation of the Artisan iris-claw lens after vitrectomyhas better results[6,10].

Implanting the iris-claw lens above the iris for aphakic eyes decreases the endothelial cell count[7,12,13,14,15,16], in most studies using the retropupillary fixation technique.De Silva et al[22] reported that corneal decompensation occurred in 1.7% of eyes.

Two studies of retropupillary iris claw intra ocular lens(RPICIOL) implantation showed pigment dispersion as a complication, but this was not seen in several additional studies[17,18,19,20,21].Disenclavation of one haptic as a complication has been reported previously[13,18,19].

Macular edemaand Ovalisation of the pupil, has also been reported previously[5,13,19]. The reported incidence of CME after secondary angle-supported IOL implantation ranges from 0% to 33%[6,23].

Rijneveld et al.[17]found iridalsynechiae in 5 % of patients undergoing RPICIOL implantation and 11 % in patients with implantation above the iris. Gicquel et al.[13] reported iridalsynechiae in three of 41 patients with RPICIOL.

Elevated IOP is seen in some cases[18,19].

Conclusion:

Iris Claw lensimplantation is effective, predictable and safe procedure capable of delivering good visual outcomes with a low complication rate in patients who are unable to undergo intracapsular or sulcus IOL positioning.

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Retinopathy of Prematurity : Clinical Perspectives

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Introduction:

Retinopathy of prematurity (ROP) is a multifactorial retinal disorder primarily of low birth weight premature infants. It can be mild with no visual defects, or it may become aggressive with new vessel formation (neovascularisation) and progress to retinal detachment and blindness.The fundamental pathological process underlying ROP stems from incomplete vascularization at birth. Normal retinal vascularization progresses in-utero from the disc margin (16 weeks) and reaches the nasal ora serrata (by 36 weeks) and then temporally (by 39-41 weeks) to complete a mature vascular retina. Term infants have completely vascularized retina and hence are not at risk for developing ROP[1]. Premature infants have avascular or incompletely vascularized retina at birth; ROP evolves over 4-5 weeks after birth. This relatively slow evolution is however usually asymptomatic and the onus of whom to send for screening lies primarily with the neonatologist/childspecialist in order to effectively conduct retinal examinations and timely interventions to improve visual outcome and avoid irreversible blindness. The incidence of ROP in India is reported to vary between 38 – 51.9 % in low birth weight infants[2,3,4]. Out of the approximate 26 million annual live births in India, approximately 8.7% of newborns in India are < 2000 grams in weight[5]. This would imply that almost 2 million newborns are at risk for developing ROP

Risk factors (1)

Birth weight and gestational age

Infants with very low birth weight are at significantly higher risk of developing severe ROP that requires treatment. Similarly, the severity of ROP is inversely proportional to gestational age. Present evidence shows that low birth weight and gestational age are the most predictive risk factors for the development of ROP.

Oxygen Use

Oxygen therapy has been previously implicated in the aetiology of ROP. The use of supplemental oxygen neither caused progression of pre-threshold ROP nor significantly reduced the number of infants requiring peripheral ablative therapy. Recent evidence suggests that repeated hypoxic and hyperoxic episodes may be an important factor in the pathogenesis of ROP. Strict management of oxygen delivery without fluctuations and monitoring may be associated with decreased occurrence of ROP. One should also avoid SPO2 >94% in preterm babies. Although the exact relationship between oxygen therapy and ROP is currently not well established, oxygen therapy seemed to play an important role in the pathogenesis of ROP.

Other Risk Factors

The other risk factors that have been implicated in the development of ROP include use of, glucocorticoids , surfactant, indomethacin , xanthine and dopamine. In addition, ROP has also been associated with intra-ventricular haemorrhage, ante-natal blood loss requiring blood transfusions and surgery under general anaesthesia , sepsis ,candidemia , hypo/hypercarbia, raised serum bilirubin levels, and assisted conception .

However, there is insufficient evidence to determine the degree of importance of these risk factors in contributing to the pathogenesis of ROP.

There is no relation between ROP and bright light exposure, maternal smoking andmaternal PIH.

Classification of ROP[11]

ROP classification is based on the location of the disease into **3 zones** (**1-3**), extent of the disease based on **clock hours** (**1-12**), **stage** (**1-5**) and the presence of plus disease.

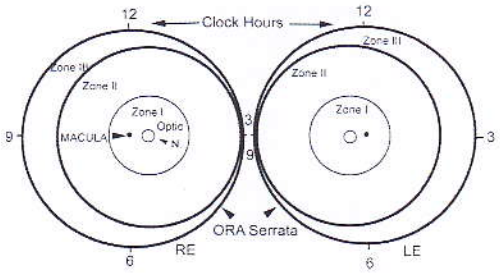
Location of ROP shown in figure 1.

a. Zone 1: innermost Zone , the radius of which is twice the distance from the centre of optic disc to macula

b. Zone 2: extends from Zone 1 to ora serrata of nasal side and about half the distance from ora serrata on temporal side.

c. Zone 3: residual crescent of retina on temporal side

Fig.1.



Extent (figure 1): it refers to the circumferential location of the disease and is reported as clock hours (1-12) in the appropriate zone.

Stage : it is divided into 5 stages

a. Stage 1: demarcation line that separates avascular retina anteriorly from the vascular retina posteriorly

b. Stage 2: ridge of scar tissue between the avascular retina and vascular retina

c. Stage 3: ridge with extraretinal fibrovascular proliferation or neovascularisation. Abnormal blood vessels extend into vitreous

d. Stage 4: partial retinal detachment due to pull of scar tissue. 4A- if detachment involves outside the fovea. 4B- if detachment involves fovea

e. Stage 5: total retinal detachment

Plus disease: it implies venous dilatation and arterial tortuosity of posterior retinal vessels, and later may include iris engorgement, rigid pupil and vitreous haze.

Pre-Plus disease: intermediate level of vascular dilatation and tortuosity between normal appearing posterior pole vasculature and frank plus disease

AP-ROP (Aggressive posterior ROP)

A rapidly progressive and severe form of ROP. The characteristic features are its posterior location, prominence of Plus disease, its ill-defined nature and rapid progression to stage 5. It is more common in

Indian babies and carries a worse prognosis as compared to classical ROP[6].

Threshold ROP

Threshold ROP is present if 5 or more contiguous or 8 cumulative clock hours(30-degree sectors) of stage 3 with plus disease in either zone 1 or 2 are present. This is the level of ROP at which risk of blindness is predicted to be at least 50% and at which the CRYO-ROP study showed that risk of blindness could be reduced to approximately 25% with treatment[7]

Pre threshold ROP

Any ROP in zone less than threshold ROP, and in zone 2, stage 2 ROP with plus disease, stage 3 without plus disease, or stage 3 with plus disease but fewer than the requisite clock hours that define threshold ROP.

Type 1 prethreshold ROP includes

i. In zone 1, any ROP and plus disease or stage 3 with/without plus disease
ii. In zone 2,stage 2 or 3 ROP with plus disease

Type 2 pretreshold ROP includes

i. In zone 1, stage 1or 2 without plus disease
ii. In zone 2, stage 3 without plus disease

Screening of ROP:*Theonus for referring patients for screening lies solely with the Neonatologist / Paediatrician.* The ideal setting for screening is under a radiant warmer in the NICU, under the guidance of the neonatologist. Discharged and stable babies may be screened in the trained ophthalmologist's clinic or in the NICU itself. The treating team should not forget to communicate with the parents regarding the risk of ROP; the need for screening preterm babies must be addressed along with the initial admission counseling itself. Documentation of such a communication is highly desirable. The baby should be swaddled and preferably fed one hour prior to examination. Pupillary dilatation should be performed about an hour prior to screening. A combination of **cyclopentolate 0.5% and phenylephrine (2.5%) drops is used two to three times about 10-15 minutes apart. Tropicamide 0.5-1% is an alternative to cyclopentolate**. The examination is carried out under topical anesthesia without any sedation, using the indirect ophthalmoscope and a 20 D or 28 D condensing lens. It must be remembered that retinal examinations are stressful and may be even painful to the infant. Swaddling the infant firmly in a thin blanket and administering 0.5-1 ml of 24% sucrose orally by syringe 1-2 minutes prior to the examination will help to provide comfort and relieve pain. Apnea and bradycardia may rarely develop during the examination in very premature babies. Resuscitation measures should be readily available. The pertinent questions regarding screening are**(1)** which neonates should be screened for ROP?**(2)** When should such screening be initiated? **(3)** How frequently should the infants be screened? **(4)**When is the screening complete?

Which infants should be screened for ROP? Screening for ROP should be performed in all preterm neonates who are < 34 weeks gestation and / or < 1750 grams birth weight. Apart from these infants, those preterm infants between 34 to 366/7 weeks gestational age or a birth weight between 1750 and 2000 grams with risk factors for ROP should also be screened[8,9,10].Risk factors for ROP in larger infants have not been clearly established. Multi-centre studies need to be undertaken to determine the incidence, risk factors and natural course of ROP in the larger preterm infants.

When should the first screening be done? The first screen should be performed not later than 4 weeks of age or 30 days of life in infants ≥ 28 weeks of gestational age. They may also be screened by the third week of life to enable diagnosis of AP-ROP[6].Infants <28 weeks or <1200 grams birth weight should be screened

early at 2-3 weeks of age, to enable early identification of AP-ROP.

How frequently should the infants be screened? Follow up examination intervals are based on the retinal findings; these findings are classified according to the revised International classification of ROP (ICROP)[11] Based on the retinal findings, the follow up examination schedule is suggested.

1 Week or less follow up
- Stage 1 or 2 ROP : zone I
- Stage 3 ROP : zone II

1 to 2 weeks follow up
- Immature vascularisation : zone I – no ROP
- Stage 2 ROP: zone II
- Regressing ROP : zone I

2 weeks follow up
- Stage 1 ROP: zone II
- Regressing ROP : zone II

2 to 3 weeks follow up
- Immature vascularization : zone II – no ROP
- Stage 1 or 2 ROP: zone III
- Regressing ROP: zone III

When should the screening be terminated? The following are the recommendations to guide when to stop further examinations[9].

a) Full retinal vascularization; this usually occurs at about the 40th week of postmenstrual age and mostly completes by the 45th week

b) Regression of ROP noted It is advisable to screen the baby every 1-2 weeks at least until the infant is 38-40 weeks of postmenstrual age.

c) When ROP has progressed to a stage when treatment is indicated.

Treatment of ROP when and how? Prior to December 2003, the CRYO-ROP treatment guidelines were followed. Only 'threshold disease' was treated. The Early Treatment for Retinopathy of Prematurity study (ETROP) [12] study showed that early treatment of Type 1 pretreshold ROP significantly reduced unfavorable outcomes to a clinically important degree. The guidelines from the above study are the currently recommended indications for ablative treatment and are summarized in table1. AP-ROP also needs early and aggressive laser treatment, often in multiple sessions to prevent retinal detachment .

Tab1. Treatement guidelines adopted from ET-ROP guidelines

Treatment of ROP			
ZONE 1	NO PLUS	Stage1	Follow
		Stage2	Follow
		Stage3	Treat
	PLUS	Stage1	Treat
		Stage2	Treat
		Stage3	Treat
ZONE 2	NO PLUS	Stage1	Follow
		Stage2	Follow
		Stage3	Follow
	PLUS	Stage1	Follow
		Stage2	Treat
		Stage3	Treat

The aim of the treatment is to ablate the entire avascular retina up to the ora serrata in a near confluent burn pattern getting as close to the edge of the ridge as possible. Laser photocoagulation delivered by the indirect ophthalmoscopic device is the mainstay of ROP treatment. Laser has supplanted cryotherapy due to better structural and functional outcomes. The child can be fed after about 30 minutes following completion of the procedure. Vital signs must be monitored. It is preferable that the child be under the supervision of the neonatologist or an anesthesiologist for at least 2-3 hours following the procedure. Post-treatment hypothermia and hypoglycemia are common and must be prevented. Mild conjunctival chemosis and hyperemia following the procedure may last for a few days and the parents must be counseled regarding this. Stage 4 or 5 ROP requires vitreo-retinal surgical intervention; retinal detachment carries a high risk of irreversible blindness. Visual rehabilitation must be offered to all visually challenged ROP babies.

Followup of ROP babies..

This may be typically scheduled after week 1, 2, 4 and 12 following treatment based on the findings recorded by the treating ophthalmologist.Infants with ROP, regardless of whether they have required treatment, are at risk for developing visual disorders such as strabismus, amblyopia, myopia and cataract;[13]. Retinal detachment may also occur during adulthood in infants with ROP. Moreover, prematurity may itself predispose to refractive errors, strabismus and lenticular opacities. Appropriate follow-up for these potential problems after discharge from the NICU is essential.Babies need to be under more intensive follow up for the first 6 months followed by a less intensive follow up schedule until young adulthood period to identify long term complications promptly.

Future of ROP screening: Photo-documentation and Tele-ophthalmology

The use of retinal wide field digital imaging (WFDI) using a portable pediatric fundus camera such as the RETCAM II, III and RETCAM shuttle (Clarity MSI, CA, USA) has become a useful adjunct to the documentation of ROP and as a screening and teaching tool[14] . The PHOTO-ROP study reports have shown that WFDI compares well with indirect ophthalmoscopy with a high diagnostic sensitivity[15]. In our country where trained ophthalmologists for ROP management are so few in number when the need is much more, the role of tele-ophthalmology in screening infants in peripherally situated semi-urban and rural centers by ROP experts in the tertiary care centers seems promising. This may enable timely referral of the affected infants to appropriate centers for further evaluation and treatment.

Summary:

ROP is emerging as one of the leading causes of preventable childhood blindness in India.

The responsibility of recognition of infants for screening lies with the pediatrician/neonatologist.

Screening for ROP should be performed in all preterm neonates who are born < 34 weeks gestation and/or < 1750 grams birth weight; as well as in babies 34-366/7 weeks gestation or 1750-2000 grams birth weight if they have risk factors for ROP.

The first retinal examination should be performed not later than 4 weeks of age or 30 days of life in infants born ≥ 28 weeks of gestational age. Infants born < 28 weeks or < 1200 grams birth weight should be screened early, by 2-3 weeks of age, to enable early identification of AP-ROP.

Communication with the parents regarding timely screening for ROP, seriousness of the issue, possible findings and consequences is extremely important.

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Intracameral Antibiotics After Cataract Surgery : A Short Review

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Endophthalmitis remains a rare but important cause of visual loss. In the current issue of ophthalmology , creuzotgarcher et al. report a retrospective series of 6371242 phacoemulsification surgeries in which the rate of endophthalmitis declined from 0.145% to 0.053% over 10 year period.

Prophylaxis strategies are important to reduce rates of endophthalmitis after cataract surgery, intravitreal injection and other procedures like intracameral use of antibiotics.

Research evidence of anti endophthalmitis benefits of intracameral antibiotics continues to accumulate. The use of intracameral antibiotics increased from 0.60% to 80.03% and investigators concluded that the intracameral antibiotics were responsible for these outcomes.

It was noted that incidence of postoperative endophthalmitis in the first world has dropped markedly over large 30 years to about 1 in 1500 cases even without intracameral antibiotics due to use of preoperative povidone iodine, a fourth generation flouroquinolone topically, proper wound construction, and intactness of the lens capsular bag at completion of surgery.

But in recent years a growing share of ophthalmologists have become convinced of the additional protective benefits of intracameral antibiotics.

Research

The European society of cataract and refractive surgeons (ESRCS)[1] performed a multicentre prospective RCT and reported that intracameral injection of cefuroxime was associated with an approximately fivefold reduction in endophthalmitis rates following phacoemulsification.

The concerns about the ERCRS study is the use of multiple different techniques and the use of topical levofloxacin, rather than fourth generation flouroquinolones.

Vancomycin has been used at centres for 20 years reported significantly reduced incidence of postoperative endophthalmitis after cataract surgery. An eleven year study was performed at North west England concuded that intracameral use of vancomycin at the end of cataract surgery markedly reduced rate of endophthalmitis[2]. The rate of endophthalmitis without intracameral vancomycin was 3 per 1000 as compare to 0.08 per 1000 with intracameral vancomycin.

A cohort study was conducted at Floridablanca, Colombia for a period of five years to evaluate post cataract endophthalmitis rate in relation to prophylactic intracameral moxifloxacin administration

showed marked decline in in the incidence of presumed infections. There was 0% rate of postoperative endophthalmitis in total of 1618 eyes who received intracameral moxifloxacin as compare to 1056 eyes , rate of endophthalmitis was 0.094%.

Another large study in India found a 0.02% endophthalmitis rate among 38160 eyes of charity patients who received intracameral moxifloxacin prophylaxis , which was one fourth the rate of 37777 eyes that did not receive intracameral moxifloxacin.[3]

Drugs	Vancomycin(10 yrs)		Cefuroxime(2 yrs)		Moxifloxacin(5 yrs)	
	Without	With	Without	With	Without	With
Cataract surgeries	3904	12702	2289	2826	1056	1618
Endophthalmitis cases	13	1	35	1	0.094%	0
Incidence	0.3%	0.008%	1.238%	0.044%	0.9	0%

Povidone iodine antisepsis is the only technique to reach category ll evidence in reducing endophthalmitis rates[4]. In contrast, intracameral antibotics are unproven and associated with increased costs as well as risks of overdoses, contaminants and increased bacterial resistance[5]. Overdoses of intracameral cefuroxime are associated with macular edema, retinal vascular leakage and uveitis[6], as well as endothelial toxicity and toxic anterior segment syndrome.

Concerns

Although 95% of postoperative intraocular infections have always been reported to be gram positive, with *Staphylococcus epidermidis* the most common, gram-negative infections tend to be devastating to the eye.[7]

A very small safety margin in ocular tissues makes aminoglycosides—long-standing favorites in medicine—poor candidates for prophylactic use. Only five agents are reasonable candidates for IC prophylaxis: the complex glycopeptidevancomycin; two cephalosporins, cefazolin and cefuroxime; and the fourth-generation fluoroquinolonesgatifloxacin and moxifloxacin. Within the cephalosporin class, cefuroxime has a broader spectrum than cefazolin. Because cefazolin has no particular comparative advantage, cefuroxime has become the favourite. Among the fourth-generation fluoroquinolones, gatifloxacin has been shown to cause dysglycemia when administered systemically, so the systemic product was withdrawn from global markets. The topical preparation of this drug, Zymar (Allergan), contains benzalkonium chloride, making it undesirable for intraocular injection. Moxifloxacin is easily available in a self-preserved and appropriately concentrated nonpreserved solution for our needs as Vigamox (Alcon) and preservative free intracameral moxifloxacin in prefilled syringes by Entod and Sunways pharmaceuticals etc, so it is the logical choice in this class. We are therefore left with three agents from which to choose: vancomycin, cefuroxime, and the moxifloxacin.

Cefuroxime has been approved by European regulators and is available for easy mixing for use in intracameral injections but MRS, penicillin resistant streptococcus pneumonia, and pseudomonas species

are resistant to cefuroxime and increased rate of endophthalmitic cases caused by resistant bacteria was reported in Europe.

In one report , 7 consecutive patients developed endophthalmitis caused by fusarium species after use of intracameral cefuroxime.

Vancomycin used at several surgery centres for many years, but a recent evidence has emerged that it can be associated with postoperative haemorrhagic occlusive retinal vasculitis(HORV).

Toxicity problems are also associated with non presevativemoxifloxacin in form of toxic anterior segment syndrome. So, none of them can be treated as ideal for intracameral prophylaxis.

The problem that have arisen from intracameral use of some antibiotics and concers over increasing antibiotic resistance led to urge moving away from antibiotic based endophthalmitis prophylaxis to antisepsis based endophthalmitis prophylaxismostly with povidone iodine.

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Descemet's Stripping Endothelial Keratoplasty: An Update

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Corneal transplant is the most successful of all the organ transplants being performed on the human body. First successful human corneal transplant was performed by Dr Zirm in 1906. Since then large number of corneal surgeons contributed to the improvement of the surgical procedure and success rate of the corneal transplants. In good prognosis cases the success rate of the procedure is 90% to 95%. Corneal surgeons still face problems of allograft rejection, post-keratoplasty astigmatism and suture related complications.[1] By the time the procedure achieved a landmark of 100 years after first successful corneal transplant, several newer lamellar procedures were evolved. The concept of component therapy for management of corneal disorders was introduced. In addition to the deep anterior lamellar keratoplasty (DALK), the concept of posterior lamellar keratoplasty was introduced. Since then number of newer surgical procedures have been introduced. Research is still going on to further take care of some of the problems associated with these newer procedures.

A Posterior lamellar keratoplasty:

This procedure was introduced by Gerrit Melles; MD[2] In this procedure lamellar dissection of the host cornea at the level of anterior two-third and posterior one- third is performed. Intrastromal trephination is performed using special corneal trephine and posterior corneal disc is removed. In the same way intra-stromal dissection of the donor cornea is performed after mounting the donor cornea onto the artificial anterior chamber. The donor disc is punched from the endothelial side and is placed in the host cornea. Later Mark Terry, MD used viscoelastic substance to dissect deeper layers and termed his technique deep lamellar endothelial keratoplasty (DLEK). [3] The procedure has a steep learning curve. It is also associated with primary graft failure, donor disc dislocation and host versus donor mismatched thickness. Because of technical difficulties and associated complications the procedure is no longer performed.

B Descmet's Stripping Endothelial Keratoplasty (DSEK):

DSEK procedure was described by Gerrit Melles.[4] In this procedure the manual dissection of the corneal stroma was avoided. Instead Descemet's membrane is stripped from the posterior cornea using DM stripper or reversed Sinskey hook (Bausch and Lomb, St. Louis, MO). Trephine mark is put on the anterior surface of the cornea and this serves as a guide to complete DM stripping. To facilitate the visualization of the Descemet's membrane it may be stained with Trypan blue dye. To enhance the visualization of the DM, the edematous corneal epithelium should also be scraped off.

Donor cornea (14 mm diameter) is placed on the artificial anterior chamber. Anterior stromal trephination up to 350 micron meter is performed. Lamellar dissection of the donor cornea is completed and donor disc is punched out from the endothelium side. The donor disc contains endothelium, Descemet's membrane and posterior stroma (150 micron meter). Lamellar dissection of the donor cornea should be performed carefully to avoid button holing, Descemet's membrane perforation, irregular thickness of donor disc and incomplete dissection.

The anterior chamber is cleared off any viscoelastic substance. Viscoelastic substance is put on the endothelial side of the donor disc. The donor disc is folded 60:40 ratio and held with the help of a special forceps. The donor disc is inserted into the anterior chamber. The insertion should be smooth and least traumatic. After insertion of the donor disc, it is unfolded using an air bubble. Once the donor disc adhered to the posterior corneal surface it is centered over the pupil. Main incision and the side port entries are closed. An intra-operative inferior peripheral iridectomy is performed to avoid papillary block glaucoma(Fig 1).

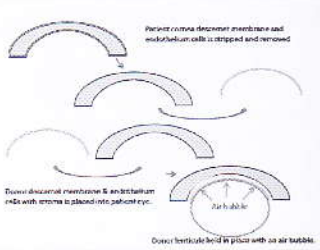

Fig.1: DSAEK diagrammatic representation

Corneal surgeon in the initial phase may select Fuchs' dystrophy or pseudophakic corneal edema with good visualization and normal anterior chamber(Fig 2,3). However the experienced corneal surgeons perform DSEK / DSAEK in patients with anterior chamber IOLs, aphakia, graft failure and glaucoma with filtering surgery (AGV).

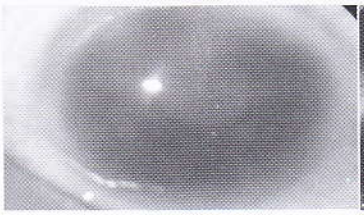

Fig. 2: Fuch,s endothelial dystrophy

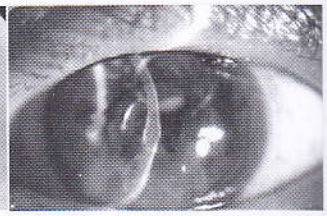

Fig. 3: Pseudophakic corneal edema

The DSEK / DSAEK procedure may be combined with phaco emulsification or sclera fixation of PCIOL.

C Descemet's Striping Automated Endothelial Keratoplasty (DSAEK):

Currently DSAEK is the most common endothelial keratoplasty procedure being performed. In DSAEK the surgical procedure essentially remains the same as in DSEK. The only difference is that the manual dissection of the donor cornea to obtain donor disc is avoided. Instead a microkeratome with 350 micron meter head is used to remove the stroma and finally donor disc is punched from the endothelial side. The donor graft preparation with microkeratome is best done by an experienced eye bank technician. Visual acuity has been reported better with DSAEK as compared to DSEK. In some of the patients whose visual acuity did not improve following DSEK, improved significantly following DSAEK, as the dissection with microkeratome is smoother than the manual dissection.

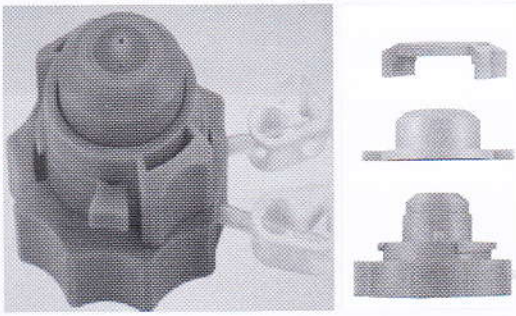

Fig. 4&5 Parts of artificial anterior chamber (Katena)

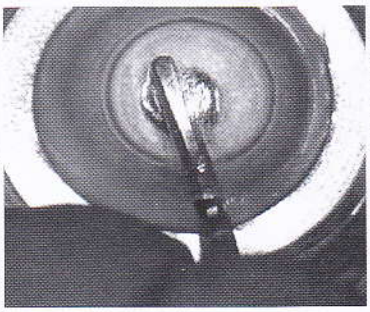

Fig. 6 Mannual lamellar dissection in DSEK

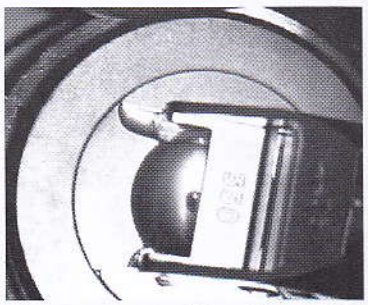

Fig. 7 Automated lamellar cutting of donor button in DSAEK

Details of the artificial anterior chamber and some surgical steps are shown in figs. 4 to 7.

Donor lenticule preparation

Microkeratome: The donor corneoscleral rim is mounted on the artificial anterior chamber. Microkeratome is adjusted to cut the anterior 350 micron stroma. IOP in the artificial anterior chamber is kept under control. Higher IOP yields thinner donor lenticule. The thinner lenticules may also be obtained by slower passes. Donor graft thickness asymmetry and irregular surface may cause postoperative

hyperopic shift. Smoothening of the irregular surface using excimer laser is currently under evaluation.

D Ultra-thin DSAEK:

Ultra thin DSAEK has been reported to enhance visual acuity results. Most corneal surgeons believe 100 micron thickness as ultra thin lenticule. However in several studies in donor lenticule of 130 micron has been considered an ultra- thin. A double pass microkeratome technique has been used to prepare ultra-thin DSAEK lenticule.[5] This technique provides thin lenticule, but increases the risk of corneal perforation and endothelial cell loss. Stromal hydration technique by injecting BSS into corneal stroma or keeping the corneo-scleral tissue in hypo-osmotic tissue culture medium have also been used to get ultrathin tissue.[6] Currently most surgeons prefer single pass technique. Busin et al have reported that visual outcome following UT DSAEK is better than conventional DSAEK and comparable to DMEK.[6] In recent publications use of DSAEK grafts sub 100 micron thickness have been used with bood visual outcome. In our experience UT DSAEK may be performed with more ease and predictable manner with the use of endosaver.

Femtosecend laser:

Femtosecond laser can be used to cut lamellar donor disc to perform DSEK. After femtosecond laser cut the donor disc is separated with the help of spatula. Femtosecond laser has also been used to aim smoother surface of donor lenticule. Studies have shown that femtosecond prepared tissues have more irregularities, rough stromal beds and increased thickness irregularity compared to microkeratome prepared tissue.[7] The irregularities in to the stromal surface have been attributed to comparison and deformation of cornea by femtoscend laser applanation cone.

Insertion techniques:

Several techniques including taco fold (60:40), use of Busin,s glide and simple glide have been described (Figs 8,9). After taco fold the disc is inserted with the help of specially designed forceps. Significant endothelial cell loss has been reported with the use of forceps. Endothelial cell loss is more in the initial cases due to learning curve. A recent study reviewed three surgical techniques, forceps assisted insertion of a 60-40 folded donor disc (taco), forceps assisted pulling and needle assisted pushing of the donor graft. Endothelial cell loss was comparable in all the three techniques.

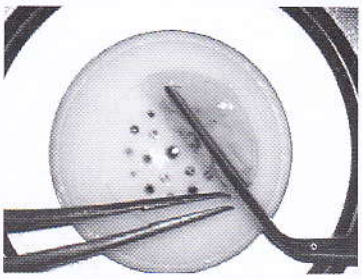

Fig. 8 Folding of donor disc (60:40)

Fig.9 Busin Glide

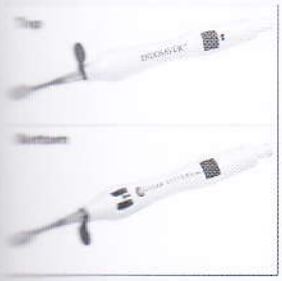

Fig. 10 Endosaver

Use of donor insertion device (EndoGlide) resulted lower endothelial cell loss compared to sheet glide.[8] Use of Busin glide has been reported to provide better endothelial cell survival following DSAEK.[9] Endosaver is another device commonly used to insert the donor disc in DSAEK.[10] The endosaver is user friendly and enhances endothelial cell survival. The insertion device has an irrigation system that keeps the anterior chamber deep during insertion of donor disc (Fig 10). In addition to the insertion technique, the incision size is also known to affect endotheial cell survival in DSAEK. In a comparative study 5 mm incisions have been reported to provide higher endothelial cell survival compared to 3 mm incisions.[11]

Complications:

Donor disc dislocation is a common complication after DSAEK. Dislocation of donor disc usually

occurs in the immediate post operative period i.e. within a week of surgery. Late dislocations have also been reported. The average dislocation rate 14.5% (range 0 – 82%) has been reported. Primary graft failure i.e. donor graft not clearing within 2 months of surgery is another complication. Compromised endothelium, blood in the interface, shallow anterior chamber and poor surgical technique may be responsible for primary graft failure. The average graft failure rate reported is 5% (0 – 29%). The corneal endothelial cell loss is higher following DSAEK compared to PK in the first year after surgery. The mean endothelial cell loss following PK ranged 11% to 29% at 2 to 6 months, 16% to 45% at 12 months and 29% to 54% at 24 months. Mean endothelial cell loss following DSAEK ranged from 25% to 54% at 6 months and 29 to 61% at 12 months.[12] Corneal allograft rejection has been reported in 10% of cases following DSEK/DSAEK. The incidence of endothelial rejection following DSAEK is lower than following PKP.[12] Glaucoma following DSAEK may occur during immediate post operative period or few months after surgery. Immediate post surgery, acute rise of IOP is due to pupillary block caused by air bubble in the anterior chamber. This may require topical and systemic anti-glaucoma medication and release of air by opening the paracentesis site. Late onset glaucoma may be due to corticosteroid use and may need anti-glaucoma medication.[12] Epithelial downgrowth, calcareous degeneration, refractile particles at interface and air bubble induced damage to the corneal endothelium have also been reported following DSAEK.[13] Anterior segment OCT and confocal microscopic evaluation is necessary in case improvement of visual acuity is suboptimal.

Early visual rehabilitation, minimal astigmatism and no suture related complications are advantages of DSAEK procedure over the conventional penetrating keratoplasty.[12] Donor disc dislocation, primary graft failure and rise of intraocular pressure are common complications observed during early post operative period. Several modifications including anterior chamber maintainer, stab incisions for interface fluid, preoperative or intra operative inferior peripheral iridectomies decompression of anterior chamber after 1 hour and scraping of peripheral recipient bed have been advocated for decreasing the incidence of complications. DSAEK may be performed as suture less procedure (Fig 11).

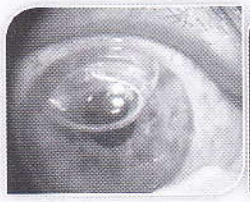

Fig. 11a DSAEK Post op at 48 hours.

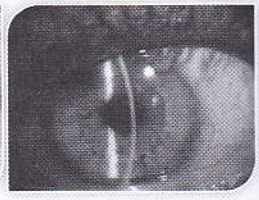

Fig. 11b DSAEK Post op at 3 week.

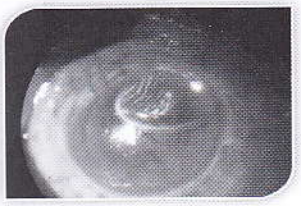

Fig. 12a DSEK with pupilloplasty Post op at 48 hours.

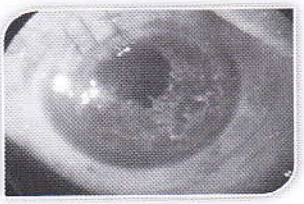

Fig. 12b DSEK with pupilloplasty Post op at 3 week.

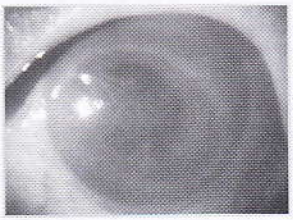

Fig. 13a Aphakic corneal edema.

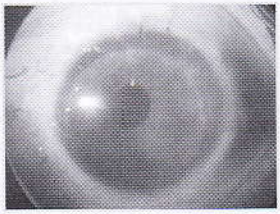

Fig. 13b DSEK with Scleral Fixated PCIOL (Combined).

DSAEK may be combined with pupilloplasty or sclera fixated PCIOL implant (Figs 12,13).

A traumatic insertion of the donor lenticule results, minimal endothelial cell loss and enhances the graft survival following DSAEK (Fig 14).

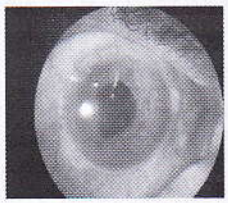

Fig. 14 DSEK after 5 years

D Descmet's Membrane Endothelial Keratoplasty (DMEK):

In DMEK transplantation of Descmet's membrane and endothelium is performed (Fig 15). Descemet's membrane is stripped from the donor cornea and injected into the anterior chamber using injector used to implant foldable IOLs. Descemet's membrane is unfolded by injecting an air bubble. It is difficult to recognize endothelial side. To identify endothelial side and to obtain optimum approximation endothelial side may be stained with trpan blue. In DMEK, the challenge is to prepare delicate graft tissue with least trauma. Several techniques to harvest the donor tissue for DMEK have been described. Melles et al described a manual technique, in which the donor corneoscleral rim is immersed in BSS and DM is pealed with one point non-toothed forceps.[14] Endothelial cell loss ranging from 4% to 7% has been reported using this technique. Giebel and Price described SCUBA (submerged corneas using backgrounds away) technique.[15] In this technique the donor cornea is submerged in the Optisol or BSS to decrease the surface tension and allows the DM to rest onto the stroma. Kruse et al harvested donor graft using a pair of forceps and reported 1% endothelial cell loss. [16] In a comparative study with DSAEK, DMEK provided better visual recovery and comparable endothelial cell loss at 6-month follow up. The DMEK group had a higher, percentage of re bubbling procedure but the difference was not statistically significant.[17]

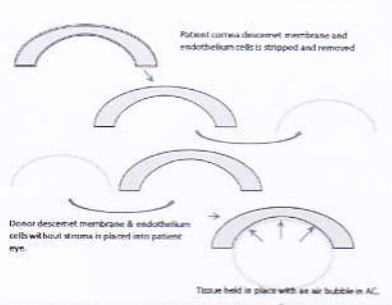

Fig. 15 DMEK diagrammatic representation

Yoereuk et al evaluated clinical outcomes of DMEK in vitrectomized eyes and found it successful in restoring visual acuity in these eyes, however the higher rate of complications was observed than the reported with standard DMEK.[18]

E ROCK Inhibitor:

Corneal endothelial decompensation in Fuchs dystrophy and pseudophakic corneal edema results in significant decrease in visual acuity. The Gold Standard treatment option for corneal decompensation remains the corneal transplant. Alternative options including hypertonic saline (5%), anterior stromal puncture, amniotic membrane transplantation, phototherapeutic keratectomy and bandage contact lenses have been advocated for symptomatic relief for patients with poor visual potential.[19] Recent experimental and human studies have reported corneal endothelial cell regeneration using Rho associated kinase inhibitor (ROCK). ROCK inhibitor Y-27632 has been documented to promote cell adhesion, proliferation and modulate apotosis in primate corneal endothelial cells in culture. [20,21] The addition of ROCK inhibitor in the culture media has also been shown to enhance the results of human corneal endothelial cell cultures. The use of a ROCK inhibitor, as intra-cameral injection for cultivated endothelial cells and as a topical eye drops, may prove to be an effective option for the treatment of corneal endothelial disorders in future.

In a comparative study DSAEK was performed in the contra lateral of the eyes those have undergone PKP.[6] In a direct comparison better uncorrected visual acuity, best-corrected visual acuity, contrast acuity, in addition to elimination of surgery-induced astigmatism and HOA were major advantages of DSAEK technique.[22] A steep learning curve, high per operative endothelial cell loss and costly equipment for cutting the donor disc are major constraints in performing DSAEK. Long term graft survival is another area of concern. In some of the studies 90% graft survival at 1 year has been reported. DMEK has the potential to achieve visual acuity equivalent or better than 20/25 in 75% (higher than DSAEK) of patients at 1-3

months.[23] In future, once the technique is standardized, corneal surgeons may prefer DMK over DSAEK. Both DSAEK and DMEK allow to benefit more than one patient from single donor cornea. DSAEK or DMEK and DALK can be performed using one donor cornea to benefit two patients.

Conclusions:

DSEK appears to be safe and effective for the management of the diseases affecting endothelium of the cornea. Surgical complication rates, graft clarity, visual acuity and endothelial cell loss following Descemet's stripping (automated) endothelial keratoplasty has been reported equivalent to PK. DSAEK has been reported superior to PK considering early visual recovery , refractive stability, postoperative refractive outcomes, wound /suture-related complications and intraoperative or late choroidal hemorrhage. DSEK/DSAEK is currently the most preferred surgical procedure for treatment of the corneal endothelial disorders. DMEK an emerging technique is technically demanding and more studies will ascertain its future.

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IMPORTANCE OF OCULAR TRAUMA SCORE

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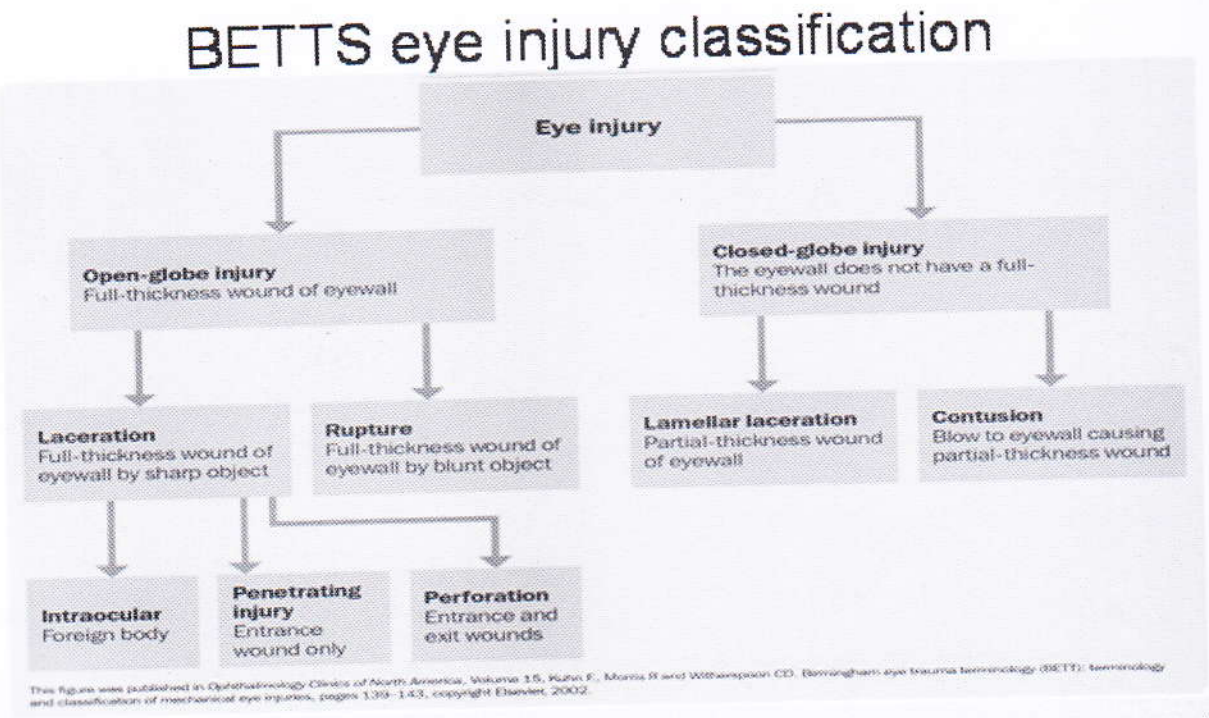
Ocular trauma is an Important cause of preventable morbidity worldwide; it accounts for half a million cases of monocular blindness worldwide. Predominantly the causes of ocular trauma include road traffic accidents, sports and work related activity in men and domestic fall and other home related activities in women. Reported risk factors are workplace, road accidents, alcoholism and lower socioeconomic class.

Despite advances in ophthalmic surgery such as operating microscopes, vitreoretinal techniques, and surgical skills together with improvements in the awareness of visual prognosis, instrumentations, and other factors that have led to better outcomes, there remain a number of eyes that cannot be salvaged. They impact not only the individuals, but also the country's healthcare system. The recent ocular trauma classification is BETTS.



There are many factors likely to predict the final visual acuity (VA) after open globe injury. They are initial VA, mechanism or type of injury, zone of injury, adnexal trauma, relative afferent pupillary defect (RAPD), retinal detachment, uveal or retinal tissue prolapse, vitreous hemorrhage, lens injury, hyphema, delay to surgery, and number of operative procedures [7-10]. One of the most important uses of knowing about prognostic factors is that it helps the physician in counselling the patient and his family and preparing him for the outcome.

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Ocular Trauma Score (OTS) system suggested by Kuhn et al. is to predict the final VA after an open globe injury. Kuhn et al. analyzed more than 2500 injured eyes from the United States and Hungarian Eye Injury Registries (USEIR) and evaluated more than 100 variables with the goal of identifying specific predictors. OTS is calculated by assigning definite numerical raw points to six variables: initial VA, rupture, endophthalmitis, perforating injury, retinal detachment, and RAPD (Table 1). The scores are stratified into five categories that give the predictabilities of final VA.

Table 1: Calculating the ocular trauma score (OTS): variables and raw points.VariablesRaw pointsInitial VA□NLP60LP/HM701/200–19/2008020/200–20/5090≥ 20/40100Rupture-23Endophthalmitis -17Perforating injury -14Retinal detachment -11RAPD -10

Variables	Raw points
Initial VA	□
NLP	60
LP/HM	70
1/200–19/200	80
20/200–20/50	90
≥20/40	100
Rupture	-23
Endophthalmitis	-17
Perforating injury	-14
Retinal detachment	-11
RAPD	-10

• Sum of raw points <20/40	OTS	NLP	LP/HM	1/200– 19/200	20/200– 20/50
• 0–44 1%	1	74%	15%	7%	3%
• 45–65 15%	2	27%	26%	18%	15%
• 66–80 41%	3	2%	11%	15%	31%
• 81–91 73%	4	1%	2%	3%	22%
• 92–100 94%	5	0%	1%	1%	5%

Ocular trauma is a common cause of visual impairment in children and can be prevented. There should be preventive measures, better supervision, public education, and aggressive and prompt management to improve visual outcomes.

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MANAGEMENT OF CATARACT IN SMALL PUPIL

Dr. Ruchi Saxena (MS), Dr. Ashutosh Khandelwal (MS, FAEICS)

A pupil that fails to dilate beyond 4 mm is often defined as small pupil. It not only impairs visualisation of lens & posterior segment but also creates hindrance in performing a successful cataract surgery.

TECHNICAL CHALLENGES IN PERFORMING A SMALL PUPIL CATARACT SURGERY

The various challenges we face while performing a cataract surgery in small pupil are:

1. Reduced red reflex
2. Increased risk of iris damage and bleeding
3. Iris prolapse from wound(s)
4. One may land up in small capsulorrhexis size which may later lead to anterior capsular damage by a chopper or ultrasonic tip or a postoperative capsular phimosis.
5. There may be incomplete evacuation of the cortical matter
6. Problem in ensuring in the bag IOL placement
7. Issues with proper alignment of toric IOL
8. Increased tissue damage may lead to CME (due to prostaglandin release)

ETIOLOGY

The causes of a non-dilating pupil are:

1. Age related iris atrophy
2. Pseudo exfoliation syndrome
3. Intraoperative floppy iris syndrome due to systemic drugs like tamsulosin
4. Diabetes mellitus
5. Posterior synechiae due to uveitis, angle closure glaucoma or previous surgery.
6. Chronic use of miotics

PRE-OP PREPARATIONS

Following preoperative planning should be done:

1. Shifting from topical to peribulbar anaesthesia; as iris handling may cause pain
2. Perform surgery under steroid cover in patients of uveitis
3. Switch from miotics to other IOP lowering drugs, at least a week prior to surgery.
4. Start topical NSAIDS atleast one week prior to surgery

Intraoperative Measures

They are directed towards making a capsular opening of at least 6mm.

A. Pharmacological Method:

1. High Molecular weight viscoelastics as sodium hyaluronate 2.3%
2. Non preserved epinephrine 0.5ml in 500ml of balanced salt solution for infusion.[1]
3. Intracameral 1% lidocaine followed by wash with balanced salt solution.

B. Synechiolysis

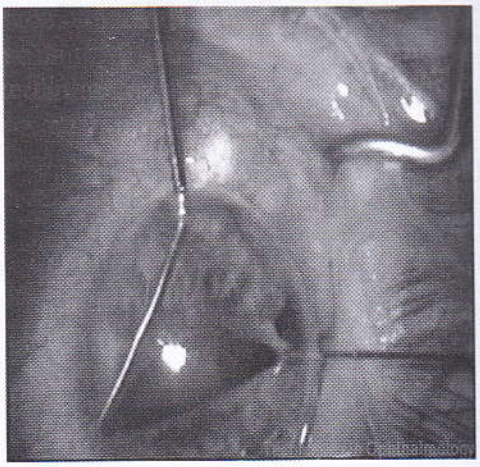
If posterior synechie is present , swipe it with cannula of viscoelastic syringe. If there is a synechial ring, strip it with capsulorrhexis forceps.

C. Surgical Methods

If above measures fail, there are other methods to enlarge the pupil. They include:

a) Mechanical stretching
b) Mini sphincterotomy

c) Iris hook
d) Ring expander
e) Iris suture



a) Mechanical stretching

Stretch pupilloplasty/ Mechanical stretching can be accomplished by using two hooks, ie, two Kuglen hooks or alternatively one Kuglen and one Sinskey hook.

One of the hooks is passed through the paracentesis and the other through the main wound. Pupil margin is engaged at the 6 and 12 o'clock positions and stretched to a maximum for 15- 20 seconds. Can be repeated at the 3 and 9oclock positions

Figure1 : Mechanical Stretching Using Kuglen Hooks

Alternatively, a two- or three-hook Beehler or Keuch pupil dilator can be used. However it stretches pupil in asymmetric four quadrant pattern.

Problems with mechanical stretching:

1. Does not prevent progressive miosis
2. Increased risk of iris prolapse due to atonicity
3. Irregular pupillary dilatation
4. Accidental anterior capsular tear
5. Should be avoided in patients with rubeosis iris, chronic uveitis, or coagulopathy; due to risk of bleeding

b) MINI SPHINCTEROTOMIES

Can be done using vannas scissor , however some prefer retinal scissors as they can be passed via paracentesis & cut sub-incisionally.[2,3] One should aim at cresentric sphincterotomies as it will lead to a physiological pupil post-operatively.

c) IRIS HOOKS:

They were initially described by Mackool[4]. He used titanium hooks attached to titanium base and iris repositor. Later they were replaced by nylon retractor with sialistic sleeves.

Disadvantages of iris hooks

1. There may be peripheral shallowing of anterior chamber
2. Too many ports have tendency to leak
3. Iris may prolapse from improperly created wounds
4. Anterior capsule damage may occur
5. DM may be injured
6. post operatively there may be irregular pupil function

d) RING EXPANDERS:

Cause circumferential expansion in physiological plane and also stabilize and protect pupil margin

Main advantages of pupil expander rings are:

1. Placement through the main incision (multiple additional paracentesis aren't necessary)
2. Protection of the iris margin
3. Prevention of iris sphincter from overstretching.

Available ring expanders are Perfect Pupil, the Morcher pupil dilator ring, the Graether 2000 pupil-expander system , the Malyugin ring system, I- Ring (Beaver Visitech International) pupil expander and the Aasia Pupil Expander.

Perfect Pupil™ (Milvella) is an incomplete ring made of polyurethane. It has an internal diameter of 7 mm, which allows a large capsulorrhexis. There is an opening of 45° which allows easy manipulation by instruments[5].

FIGURE 2: The Perfect Pupil

Morcher Pupil Dilator Ring™ is a rigged ring made up of polymethyl methacrylate (PMMA) and has an internal diameter of 7.5mm

Figure 3: Morcher Pupil Dilator Ring

Graether 2000 Pupil Expander System™ (Eagle Vision) it also has an internal diameter of 7.0mm, is made up of soft silicone and has a grooved outer circumference which engages the iris.

Figure 4: Graether 2000 Pupil Expander

The Malyugin Ring System™ (Microsurgical Technology) It consists of a holder and inserter packaged with a ring. It has 8 fixation points with absence of sharp edges and a reliable clamping mechanism and hence causes minimal trauma to the iris tissue. Various models are available. One made up of 4-0 polypropylene enters via a 2.2mm incision while Malyugin ring 2.0, made up of 5-0 polypropylene can even be introduced via a 2.0mm incision.

Figure 5: The Malyugin Ring

The Assia Pupil Expander (APX)™ (APX Ophthalmology)
It has two tiny spring loaded devices which can be introduced via 1.1mm side-port incisions . It requires no intraocular manipulation.

Lastly, 10-0 nylon sutures can also be used when iris hooks and other devices are unavailable. Peripheral iris can be captured and sutured to clear cornea with 10-0 nylon suture.[6]
Therefore, whenever you encounter a small pupil, enlarge it, to make the surgery enjoyable for the surgeon and safer for the patient.

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NEW FRONTIERS IN THE TREATMENT OF NORMAL TENSION GLAUCOMA

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ABSTRACT:

Normal Tension Glaucoma (NTG) is labelled when typical glaucomatous disc changes, visual field defects and open anterior chamber angles are associated with intraocular pressure (IOP) constantly below 21mm hg. Chronic low vascular perfusion and Raynaud's phenomenon are the main causes of normal tension glaucoma.

Treatment is generally aimed at lowering IOP by 30 % from pre – existing levels to 12-14 mm hg.

Studies now show that the choice of medication may also be important in determining the outcome for the patients. The present review summarizes the treatment of NTG.

KEYWORDS:

Normal Tension Glaucoma (NTG), Neuroprotection, Intraocular pressure(IOP), Glaucomatous Optic Neuropathy (GON)

INTRODUCTION:

Glaucoma is a progressive optic neuropathy that causes characteristic optic nerve and visual field changes in relation to IOP.[1] It is now known that glaucoma can occur at statistically normal IOP and prevalence studies have shown NTG to be more common than previously thought.

Both glaucoma phenotypes have normal anterior chamber angles, peripapillary retinal nerve fiber layer (RNFL) thinning, GON, and corresponding visual field (VF) defects[2,3]. Because of these similarities, it has been postulated that NTG and high-pressure POAG represent a continuum of open-angle glaucomas and differ basically in the importance of IOP on the development and progression of the disease[4]. Therefore, it is crucial to define glaucoma based on the characteristics of the optic nerve and not to use a single risk factor, IOP, to distinguish among the various conditions of GON.[2]

Visual field defects in NTG are essentially comparable to POAG. In general, patients with NTG appear to have deeper, more localized scotomas[4],a difference in the progression pattern as compared to POAG patients; in POAG eyes, field defects initially increased in area and later in depth, whereas in patients with NTG, the increases in area and depth remained in constant proportion.[5]

Investigations include 24-hour blood pressure monitoring to exclude nocturnal systemic hypotension; blood tests to rule out other causes of glaucomatous optic neuropathy such as vitamin B12 and

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folate levels, ESR/CRP and serum ACE. Cranial MRI may be necessary to rule out intracranial space occupying lesions (SOLs); and nail fold capillaroscopy with cold provocation may detect blood flow abnormalities.[6]

Pathogenesis

The pathogenesis of NTG is unclear, and perhaps the development of the disease is a consequence of a complex interaction of several systemic and ocular factors. Different studies have shown that the cardiovascular system and intracranial pressure may be involved in the main pathways of optic nerve damage. Nevertheless, the complex relationship between these mechanisms and glaucoma progression continues to be debated.

DIAGNOSIS AND EVALUATION

Diagnostic evaluation of NTG should always begin with thorough medical history and review of systems. It is not uncommon for such patients to communicate a history of cold extremities, migraine headaches, systemic hypotension, or other signs of vascular dysregulation.[7-8]

A systemic evaluation of potentially contributing conditions, such as Obstructive Sleep Apnoea (OSA) or Raynaud's phenomenon, is often significant in cases of disease progression refractory to IOP lowering therapy. The diagnosis of NTG can even be diagnostic in some patients who were previously unaware of the presence of contributing systemic disease. Since NTG is a disease entity in which non ocular systemic abnormalities are believed to play a significant role in disease progression, optimization of potential IOP – independent factors can be helpful in slowing the progression of eye disease. When the rate of disease progression remains unchanged despite optimization of both IOP and IOP- independent risk factors, the diagnosis of NTG should be re-evaluated and a work-up for non-glaucomatous causes of vision loss should be considered.

TREATMENT:

The mainstream treatment for NTG is IOP reduction. The Collaborative Normal-Tension Glaucoma Study demonstrated that a 30% IOP reduction favorably influenced the progression of this disease in glaucoma patients compared with untreated NTG controls. The favorable effect of IOP reduction in the treated group was found only when the impact of cataracts on VF progression was nullified. Moreover, in the same study, even after achieving the expected IOP reduction, the disease continued to progress in 12% of patients[9-10].

The most frequently prescribed antiglaucoma drugs used in monotherapy in several studies did not reach the pressure reduction suggested by the Collaborative Normal-Tension Glaucoma Study. Prostaglandin analogues (latanoprost and bimatoprost), beta-blockers, and alpha-adrenergic agonists reduced the pressure from 16% to 20% when used in monotherapy[11-12]. Among fixed combinations of drugs, the dorzolamide-timolol compound reduced 23.7% of baseline IOP, and combined brimonidine-timolol drops lowered IOP by 3.8 mmHg (23%) after 12 weeks of use in NTG patients[13-14].

The Low-pressure Glaucoma Treatment Study compared the effects of brimonidine and timolol in monotherapy for NTG. Brimonidine-treated patients were less likely to have VF progression despite known comparable IOP decreases[15]. Hayreh *et al.* suggested that topical beta-blocker eye drops induce a significant drop in mean diastolic BP at night and that beta-blocker-treated NTG patients showed VF damage progression more frequently than those not receiving this class of eye drops[16].

Extracts of *Ginkgo biloba* have been suggested for many years to treat various conditions,

particularly circulatory problems, Alzheimer's and other age-associated dementias, cerebral blood insufficiency, and schizophrenia[17]. Several studies have been conducted to test its potential as a neuroprotective and antioxidative drug and to understand the possible benefits in the management of neurological and vascular conditions[18]. Lee *et al.* reported that a prolonged (72.1 ± 16.4 months) administration of *G. biloba* slowed the progression of VF damage in patients with NTG, particularly in the superior central region[19].

Furthermore, several drugs that act on ocular blood flow have been tested. Calcium channel blockers, such as nimodipine, normalized the retinal blood flow in NTG patients with vasospasticsymptoms[20] and increased the blood and choroidal flow[21]. However, its potential benefits must be validated in randomized clinical trials.

Unoprostone is another drug with potential neuroprotective properties in pre-clinical studies. Unoprostone is a prostanoid and synthetic docasanoid that is approved by the United States Food and Drug Administration for IOP reduction in OAG and ocular hypertension through increased aqueous outflow via the trabecular meshwork. Recent studies suggest that unoprostone may prolong neuronal survival independent of its ability to lower IOP, in part due to improved ocular blood flow via antagonism of ET-1.[22,23]

Glaucoma filtering surgery is indicated when adequate control cannot be achieved with medical therapy or laser trabeculoplasty. Because the target IOP is often lower in NTG than in POAG, NTG patients are at greater risk for ocular hypotony and related complications, such as hypotonymaculopathy, post-operatively.

Aqueous shunts are another surgical option which have become increasingly popular in the past decade and especially so after the recent Tube Versus Trabeculectomy (TVT) study. It should be noted that the TVT study did not demonstrate superiority of tube shunts over trabeculectomy as primary glaucoma surgery and such a trial is currently in progress.More recently, the concept of "non-penetrating" glaucoma surgery has gained interest for its potential to limit some of the complications associated with more invasive procedures to lower IOP.

Subsequent prospective studies comparing non-penetrating deep sclerectomy directly with trabeculectomy have shown similar IOP-lowering results with improved complication rates,[24,25,26,27] suggesting that such less invasive surgical procedures may have an increasing role in the treatment of NTG and other forms of glaucoma.

CONCLUSION

The complex etiology of NTG is not yet completely understood; however, several studies presented differences between this disorder and high- pressure POAG . In clinical practice, the adequate reduction of IOP remains the keystone for managing NTG patients. Some alternative treatments must be tested further in randomized clinical trials to verify their therapeutic effects.

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Peripheral Keratitis – Mooren's ulcer

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Corneal periphery is arbitrarily considered as an area of 3.5-4.5 mm from the visual axis coinciding with the flattening of the corneal curvature .

Anatomy of peripheral cornea and Importance

The peripheral cornea has distinct morphological and immunological characteristics that predisposes it to inflammatory reactions . Corneal periphery is about 0.7 mm in thickness as against the central 0.5 mm . Unlike the avascular , the limbus and the peripheral cornea derive part of their nutrient supply from the capillary artery ,which extends approximately 1-2 mm in the cornea involvement of vascular supply can result in inflammatory cell recruitment and corneal necrosis due to liberated collagenolytic and proteolytic enzymes from these cells. Additionally, Langerhans cells are present in great number figure and along with antigen presenting limbal macrophages perpetuate and immune mediated corneal disease.

Channels from subconjunctival lymphatics accompany the limbal capillaries into the peripheral cornea and provide the access to the afferent arm of the immune system. In addition , the limbus and adjacent conjunctiva serves as the reservoir for various cells of the immune system & proinflammatory of cytokines .

Peripheral keratitis classification

A. Local Causes

1. Infection : bacterial , viral , fungal , chlamydial, parasitic
2. Hypersensitivity or Immune Mediated
   - a. Marginal Keratities
   - b. Phlectenulosis
   - c. Vernal disease
   - d. Immune rings
   - e. Moorens ulcer
   - f. Anaphylactic marginal keratitis
   - g. Rosacea keratitis
3. Traumatic or Toxic
4. Miscellaneous
   - a. Superior Limbic keratitis
   - b. Keratoconjunctivitis sicca
   - c. Exposure keratopathy
   - d. Neuroparalytic keratitis

B. Systemic Causes :

1. Metabolic Disease : Superior Limbic keratoconjuctivitis
2. Systemic Vasculitides

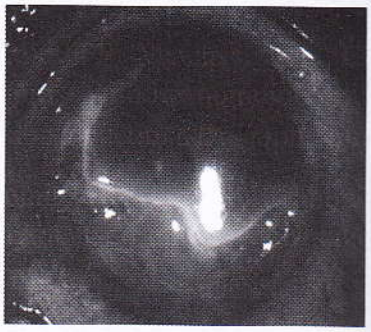
a. Rheumatoid arthritis
b. JRA
c. SLE
d. Relapsing Polychondrities
e. Sjogren's syndrome
f. Wegeners granulomatosis
g. Polyarteritiesnodosa

3. Dermatological Conditions : Ectodermal Dysplasia , rosaceae , psoriasis
4. Miscellaneous : blood dyscrasis inflammatory bowel disease .

C. Non Inflammatory Conditions Of Peripheral Cornea.

1. Degenerations.
   a. Pinguecula.
   b. White limbal girdle of vogt
   c. Band keratopathy
   d. Pterygium
   e. Post irradiation scleromalacia
   f. Dellen
   g. Terriens degenerations
   h. Pellucids degenerations
2. Metabolic disease & deposits of substances:
   a.Chalcosis: KF ring
   b.Iron deposits : ferry line , stockers line
   c.Gold deposits in chrysiasis (in treatment of RA)
   d.Drug deposits :eg phenothiazines
   e.Mucopolysaccharides
   f.Lipids in hyperlipidemia
3. Dysplastic & Neoplastic Conditions
   a.Limbal melanoma
   b. Limbalepibulbar dermoid
   c. Squamous cell carcinoma intra epithelial epithelioma

Mooren's ulcer



Mooren's ulcer is a painful, progressive, chronic ulcerative keratitis that begins peripherally and progresses circumferentially and centrally. It is an idiopathic disease occurring in complete absence of any diagnosable systemic disorder that could be responsible for the progressive destruction of the cornea. Bowman published the first report of Mooren's ulcer in 1849. Later, in 1854, McKenzie described it as 'chronic serpiginous ulcer of the cornea or *ulcus roden*.'[1]The disorder was named as Mooren's ulcer after DrMooren, who was the first to clearly describe this insidious corneal problem and define it as a clinical entity in 1863 and 1867.[2]

Etiology

Mooren's ulcer has been associated with different entities, often leading to the conjecture that there may be a causal relationship. Multiple studies including collaborative studies have reported association between Mooren's ulcer and hepatitis C infection.[3-4] Many of these patients responded to interferon

therapy.[5,6] Infectious associations have been reported with hookworm infestation.[7,8] These authors proposed that molecular mimicry might be involved, with the infecting agent stimulating an autoimmune response to corneal antigens through cross-reacting epitopes. Alternatively, they also proposed that deposition of immune complexes in limbal or peripheral corneal tissues led to an immune response and release of proteolytic enzymes.

Pathogenesis

The pathogenesis of Mooren's ulcer remains uncertain. The cellular population found in the conjunctiva adjacent to the ulcer and in the peripheral edge of the ulcer is primarily plasma cells, lymphocytes, and macrophages.[9-11] In addition, there are neutrophils, eosinophils, and mast cells. There is increased binding of IgG, IgM, and C3 to the epithelium of conjunctiva adjacent to the ulcer.[9] Kafkala et al., in a recent publication, demonstrated upregulation of various adhesion and co-stimulatory molecules in epithelial cells in the conjunctiva of Mooren's ulcer patients.[12] In this study, the ratio of CD4/CD8 cells and B7-2/antigen-presenting cells were significantly higher in Mooren's ulcer specimen. Gottsch and colleagues demonstrated antibodies to an autoantigen that exists in corneal stroma.[13] The antigen, known as 'cornea-associated antigen', has an amino acid sequence identical to that of calgranulin C of neutrophils. The human leukocyte antigen (HLA) system is a critical component for immune recognition and various studies have identified association between HLA-DR17 and the occurrence of Mooren's ulcer.[14,15] All this evidence supports an autoimmune basis for the disease. Mooren's ulcer may represent a final common pathway to a variety of insults to the cornea in susceptible patients. Trauma or infection may alter normal corneal antigens, which may lead to an autoimmune response.

Types

Wood and Kaufman described two clinical types of Mooren's ulcer.

The first, limited type, is usually unilateral, with mild to moderate symptoms, and generally responds well to medical and surgical treatment. This type is believed to occur in older patients and is known as typical or benign Mooren's ulcer.

The second type is bilateral although both eyes may not be affected simultaneously, with relatively more pain and generally a poor response to therapy. The bilateral variety primarily occurs in younger patients and is known as atypical or malignant Mooren's ulcer. This variety of the ulcer progresses relentlessly and is more likely to result in corneal perforation.

Clinical Features

Symptoms

Patients with Mooren's ulcer usually complain –

- redness,
- tearing, and
- photophobia,
- pain is typically the outstanding feature.
- The pain often is incapacitating and may well be out of proportion to the inflammation.
- There may also be a complaint of decreased visual acuity, which may be secondary to associated iritis, central corneal involvement, or irregular astigmatism due to peripheral corneal thinning.

Signs

- Typically, Mooren's ulcer begins as a crescent-shaped gray white infiltrate in the peripheral cornea. Epithelial breakdown and stromal melting follow this. Eventually it develops into a characteristic

chronic crescent-shaped peripheral ulcer. The ulcer is concentric to limbus; the leading edges are undermined, infiltrated, and deepithelialized. The ulcer progresses circumferentially and centrally.

- As it progresses, it creates an overhanging edge at its central border.
- Though the ulcer may begin as a shallow furrow in the peripheral cornea, over time it may involve the limbus. The adjacent conjunctiva and sclera are usually inflamed and hyperemic.
- Mooren's ulcer most of the cornea is lost, leaving behind a central island surrounded by area of grossly thinned, scarred, and vascularized tissue. Although the disease is characterized by progressive thinning, corneal perforation is uncommon .
- Iritis sometimes is associated with Mooren's ulcer. Hypopyon is rare unless secondary infection is present.
- Glaucoma and cataract may complicate the process

Differential Diagnosis:

Some conditions with peripheral thinning and ectasia like Terrien's and Pellucid'smarginal degenerations may confused with Mooren's. But both are non-inflammatory conditions and affect only the cornea with no scleral involvement. Also, the epithelium is usually intact unlike in Mooren's. Terriens is mostly bilateral and asymptomatic till long time after onset. It may occur at any age and Mooren's is usually is a disease of > 20 year olds.

Catarrhal Ulcer (Marginal Ulcer) may be distinguished by lucid interval between limbus and affected cornea and lack of pain which is characteristic of Mooren's

Characteristic	Mooren's Ulcer	Terrien's Degeneration `	Pellucid Degeneration
Pain	+	-	-
Visual Loss	+	+/-	+/-
Location	Anywhere	Superior	Inferior
Progression	Rapid	Slow	Slow
Central Imvolvement	+	-	-
Epithelial Defect	+	-	-
Stromal Thinning	+	+	+
Ulcer Characteristics	Central Overhanging edge	Liquid Deposition	Central flattening
Ulcer Visualization	+	+	-
Ocular Inflammation	+	-	-
Visual Threat	Central Opacification Perforation	Astigmatism	Astigmatism
Treatment	Immunosupressives Conjuctival Resection Tectonic Keratoplasty PK	Contact Lenses Tectonic Keratoplasty	Contact Lenses Tectonic Keratoplasty

Treatment

The goals of treatment in Mooren's ulcer are to stop the ulcerative process and allow reepithelialization of the cornea.

Four strategies underlie most of these treatments:
(1) local immunosuppression,
(2) systemic immunosuppression,
(3) removal of local stimulatory antigens, and
(4) removal of distant stimulatory antigens.

The following **stepwise** approach to management is recommended:
(1) topical corticosteroids,
(2) conjunctival resection,
(3) systemic immunosuppression, and
(4) additional surgery.

***Topical corticosteroids*:** These are used aggressively on an hourly basis, along with topical prophylactic antibiotics and cycloplegic medications. When the cornea shows signs of reepithelialization the steroid therapy is tapered gradually over months.

***Conjunctival resection*:** This removes involved conjunctiva and blocks collagenase and the immune response to corneal antigen by providing a biological barrier. In this procedure, conjunctiva adjacent to the corneal ulcer is resected up to 2 clock hours on either side to bare sclera and extends 3–4 mm from the limbus. Postoperatively, topical corticosteroids and antibiotics are continued

Systemic immunosuppression

Those cases of bilateral or progressive Mooren's ulcer that fail therapeutic steroids and conjunctival resection Systemic corticosteroids can be given to suppress inflammation and arrest progressive corneal thinning. The recommended dosage for oral prednisolone is 1–1.5 mg/kg body weight/day. The dosage is adjusted according to the severity of the disease and is tapered slowly when improvement occurs.

Other systemic immunosuppressants used in the management of Mooren's ulcer are: cyclophosphamide (2 mg/kg/ day), methotrexate (7.5–15 mg once weekly), and azathioprine (2 mg/kg/day). The degree of fall in white blood cell count is considered as the most reliable indicator of immunosuppression produced by cyclophosphamide.

Oral ciclosporin A (3–4 mg/kg/day) has been successfully used to treat a case of bilateral Mooren's ulcer unresponsive to local therapy as well as systemic immunosuppression.

Other agents

***Topical ciclosporin*:** Recently, topical ciclosporin 0.5% ophthalmic solution 4 to 6 times daily has been successfully used to treat Mooren's ulcer without the potential side effects of oral immunosuppressants.[16]

Interferon alpha-2b: Treating chronic hepatitis C patients with subconjunctival injections of interferon alpha-2b over a 6-month period has been shown to improve healing of Mooren's ulcer after other more conventional forms of treatment for the ulcer have failed.[17,18]

Additional Surgery

Various surgical procedures used are:

***Keratoepithelioplasty*:** In this procedure the ulcerated corneal tissue and adjacent conjunctiva are removed and donor corneal lenticules with intact epithelium are sutured onto bare sclera.[19] There are two theories to

explain success with this procedure. According to one theory, intact corneal epithelium has antiangiogenic properties and the Bowman's layer is quite resistant to cell invasion. Another theory is that the transplanted lenticules mask the biological signal of surgical damage to corneoscleral tissue

***Lamellar keratectomy*:** In this procedure four-fifths of the corneal thickness is excised. The procedure controls the inflammatory process by removal of the corneal antigenic stimulus.

***Lamellar keratoplasty*(LKP):** LKP is widely used at present for the treatment of Mooren's ulcer. The procedure removes antigenic targets of the cornea, prevents immunological reactions, reconstructs the anatomy and prevents it from perforating, and improves vision. The surgical procedure involves removal of necrotic ulcerative cornea and reconstruction of anatomical structure using lamellar donor lenticule.
Tissue adhesive and bandage contact lens: In cases of perforation or impending perforation, tissue adhesive with bandage contact lens may be used to seal small perforations.

Tectonic grafts (patch graft or penetrating keratoplasty): Large perforations cannot be managed by tissue adhesive and require tectonic grafts such as a patch graft or penetrating keratoplasty.

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Recent Update in Retinopathy of Prematurity

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INTRODUCTION

Retinopathy of prematurity (ROP) is a vaso-proliferative disorder of developing retina. It occurs principally in premature children but not exclusively. ROP was first described as "retrolental fibroplasia" in 1942. Prematurity continues to be the single most important risk factor for ROP.

The pathogenesis of ROP is still not fully understood but involves an intricate interplay between retinal blood vessels, oxygen, angiogenic and growth factors, of which vascular endothelial growth factor (VEGF) is most important.

Clinical picture of ROP is very similar to other vasoproliferative disorder of retina but having two major differences:

1) Proliferating elements are developing mesenchyme and

2) Progression is very fast i.e. more aggressive form.

ROP is described in two phases.

The first phase begins after preterm birth secondary to the hyperoxicextrauterine environment and involves suppression of VEGF, vaso-obliteration with cessation of retinal blood vessel growth and endothelial apoptosis.

The second phase is proliferative and involves neovascularisation of retinal vasculature by vasoactive factors such as VEGF, produced secondary to hypoxic and avascular retina of phase 1. The second phase begins around 32 weeks postmenstrual age but can have a wide range of onset.

EPIDEMIOLOGY

ROP is one of the more severe consequences of preterm birth and a major cause of childhood blindness and visual impairment in the developing and developed world.

The disease is more common in infants of less than 31 weeks gestation with infants of lesser gestation at higher risk and severity of ROP.

A Korean study reported a 20.7% incidence and reported that a GA of 28 weeks or less and a birth weight of 1000 g or less were the most significant risk factors.

In infants with a birth weight of <1500 g, the reported incidence of ROP ranges from 20% to 50% in different populations.

Mortality :

Long term outcomes for serious disease include several visual impairment and blindness. In addition myopia, amblyopia and strabismus may occur.

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Race :

Some reports indicate a decreased incidence of progression to threshold disease in black infants.

Sex :

Although some reports indicate a male predilection, the CRYO-ROP study revealed no differences based on sex.

Age :

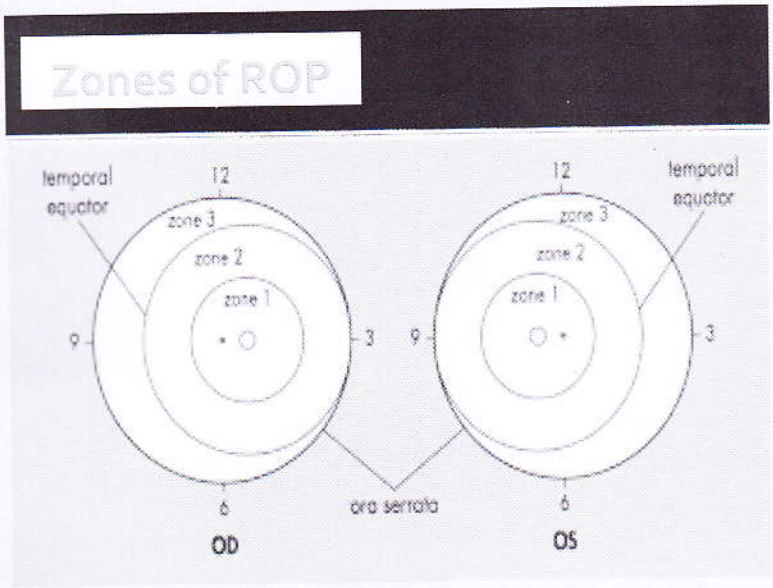
Retinopathy of prematurity is a disease of the immature retina, and the occurrence of ROP is inversely related to gestation age.

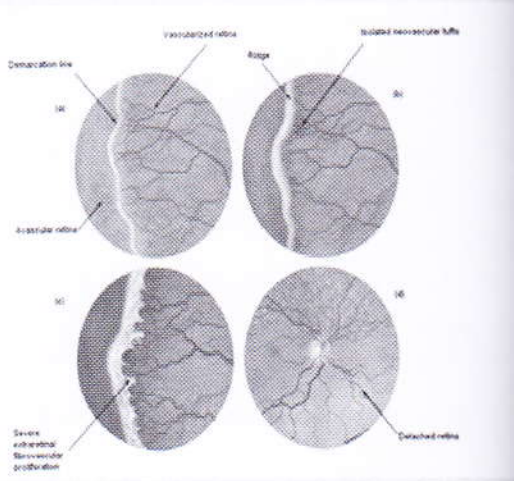
GLOBAL INFORMATION

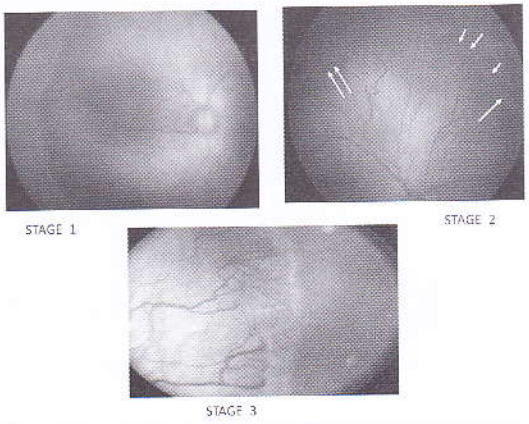
- Retinopathy of prematurity (ROP) is a leading cause of preventable childhood blindness in middle-income countries (Gilbert, 2008).
- ROP occurs primarily in infants of low birth weight and low gestational age at birth.
- Most studies report ROP incidences that are about 60% for babies less than 1500 g (Zin and Gole, 2013).
- The worldwide prevalence of blindness due to ROP is approximately 50,000.
- One of the greatest challenges in less-developed countries is having adequate screening done by ophthalmologists trained to diagnose ROP with indirect ophthalmoscopy.
- Telemedicine with the use of digital imaging and fundus photography may also be a potential strategy for ROP screening in regions where there are few trained ophthalmologists who can manage ROP.

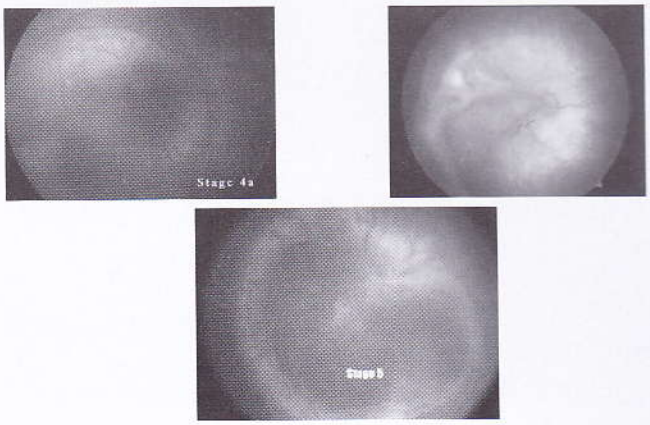
REGIONAL INFORMATION (INDIA)

- The incidence of ROP is increasing in India because of improved neonatal survival rate.
- Out of 26 million annual live births in India, approximately 2 million are <2000g in weight and are at risk of developing ROP.
- The incidence of ROP is between 38 and 51.9 % in low birth weight infants.









SCREENING FOR ROP

Which children are to be screened for ROP ?

1) Less than 1500 g birth weight.

2) Less than or equal to 32 weeks of gestational age.

3) exposed to oxygen for than 30 days.

When should the screening be done ?

32 weeks of post conceptional age (PCA) or 4-5 weeks after birth

Whichever is earlier but usually no need to examine the child in first 2 weeks after birth.

How to perform the screening examination for ROP

Before embarking upon the screening exam for ROP one has to keep in mind that the children to be screened are premature infants and thus susceptible to a particular set of problems.

PLACE : The ideal place for the screening is a temperature controlled room, since premature neonates are susceptible to hypothermia.

Preparation of the child : The Pupils are dilated with a mixture of phenylephrine 2.5% & tropicamide 0.5% instilled 3 times at 10 min. interval about one hour before the screening.

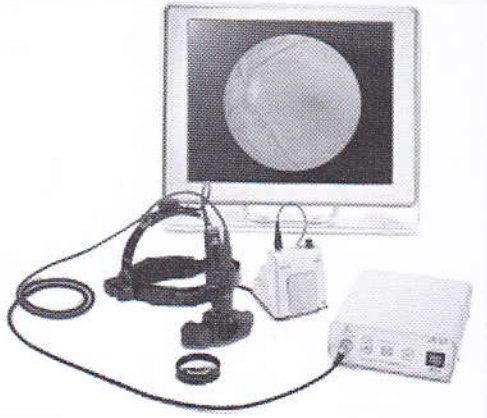
Alternatively a combination of 0.2% cyclopentolate& 2.5% phenylephrine may be instilled twice at 5 min. interval.

RetCam 3

- It is a wide angle pediatric retinal imaging system useful for screening ROP.
- It is non stressful way to screen premature babies & easier to perform.
- It can be use in undilated pupils.
- Images can be magnified

VIDEO INDIRECT OPHTHALMOSCOPE

It is also called poor man's Ret Cam 3. It is done using 20D & 28 D(preferably 28 D) lens under sedation. It also gives a good stereoscopic view both to examiner and viewer, inexpensive, light weight, portable and enable proper documentation in screening ROP.



When should we treat ROP?

The classical criteria for treating ROP is given by the CRYO ROP study.

- Stage 3 with Plus disease in zone 1 or 2
- 5 contiguous / 8 interrupted clock hours of stage 3.

We now perform cryo/ laser if -

- 3+ ROP in 3 contiguous / 5 cumulative clock hours in zone 2.
- Any stage of ROP with Plus disease in Zone 1.
- The child is re-examined after treatment at 72 hours & any skip area are retreated.
- Once ROP of stage 3 + severity is detected, the treatment should be initiated within 72 hours of detection in order that the treatment is effective.

Surgery in ROP

- In the absence of any other form of treatment in advanced stages of ROP if remains as a last hope in salvaging a small island of vision.
- The indication of surgery begins with stage IVB, when there is peripheral retinal detachment due to traction by proliferating vascularized tissue.
- In stage IVB, a scleral buckling often is necessary in the form of a silicon band.
- Moreover the buckle needs a removal at a later date so as to prevent strangulation of sclera& eye as a whole.
- Therefore the second surgery needs to be planned and performed.
- Stage V is an advanced stage where surgery is not only difficult but results are unpredictable.
- The surgery primarily involves removal of lens, separating and dissecting out retinal adhesions and flattening the retinal folds as much as possible.
- Lens sparing is also a point which is often discussed.
- In view of poor outcome of surgery in severe ROP case, it is emphasized that the cases at risk should be identified early and preventive measures in the form of follow up.

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Insulin like growth factor (IGF) in ROP

- It is a polypeptide hormone critical to normal vascular development.
- IGF acts indirectly as a premissive factor by allowing maximal VEGF stimulation of vessel growth.
- Lack of IGF in preterm infants prevents normal retinal vascular growth allowing pathological neovascularization.
- IGF measurement will give a rough idea about development of ROP.
- Serum IGF-1 level is directly related to the gestational age of the infants.
- Lower the serum IGF-1 level the more the chance of developing severe ROP.
- IGF-1 level correlates for development of retinopathy of prematurity (ROP) in serum of premature

infants.

- 73% of infant developed Stage 1 ROP and the rest develop Stage 2.
- Zone III involvement never progress beyond Stage 1, and Zone II beyond Stage 2.
- Severity of ROP could not be related to the level of IGF-1.
- All cases develop ROP of Stage 1 and Stage 2 irrespective of serum IGF-1.
- The study was presented in EU RETINA nice france and published in journal 'ANNALS OF OPHTHALMOLOGY'

CLINICAL TRIALS IN ROP

- Multicenter trial of cryo-therapy for retinopathy of prematurity CRYO-ROP
- Light reduction in ROP study (LIGHT- ROP)
- Supplement therapeutic oxygen to prevent PTh(prethreshold) ROP (ROP)
- High oxygen percentage retinopathy of prematurity (HOPE-ROP)
- Vitamin E trial
- Early treatment for retinopathy of prematurity(ETROP)
- Beat ROP(Bevacizumab in the treatment of ROP)

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Spontaneous Rotation of Toric Implantable Collamer Lens (Toric IPCL) in a Post-traumatic myopic eye

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Key words

Myopic astigmatism, Toric Implantable Phakic Contact Lens, Rotation, IPCL complications

Abstract

We present a case of toric implantable phakic contact lens (Toric IPCL) spontaneous rotation in a patient with myopic astigmatism. A 35 year male with a history of trauma in right eye underwent Toric IPCL implantation in same eye. Preoperative uncorrected visual acuity (UCVA) was 5/60 and 6/24 respectively, while best corrected visual acuity (BCVA) was 6/9 and 6/6 with -7.00D sph/ -3.00D cyl@70° and -1.00D sph/-1.00D cyl @135°. After implantation of toric IPCL his right eye achieved BCVA of 6/6 with -0.75D cyl@170°. After 2 weeks the patient presented with sudden decrease of vision in his right eye. His BCVA was 6/18 with correction of +1.00D sph/-4.00D cyl @50°. It was seen that the lens had rotated. We decided to reposition the Toric IPCL and after repositioning we obtained BCVA of 6/6 with correction of 0.75D cyl @140°. But again Toric IPCL rotated after 3 months and repositioning was done. This again happened after few weeks. So there were three episodes of Toric IPCL rotation. After discussing with patient we planned for Toric IPCL explantation and performed clear lens extraction with toric IOL implantation. Patient achieved UCVA of 6/6 and N6 with near addition of +2.50 D. TIPCL can present a considerable rotation that compromises visual acuity. The relocation of TIPCL is a safe and effective procedure to recover visual acuity due to significant spontaneous TIPCL rotation. In post traumatic eyes, the anterior chamber depth may be unpredictable and hence the chance of rotation of toric IPCL should be explained to the patient so as to avoid future issues.

Introduction:

Phakic IOLs (pIOLs) are an accepted treatment modality for correction of ammetropia, particularly in patients not suitable for corneal refractive procedures [1-7]. They have gained popularity amongst refractive surgeons due to significant advantages such as stability of correction, better quality of vision, reduced aberrations, preservation of accommodation, less dry eye and reversibility [8,9]. However, there are certain complications associated with them which are reported in literature. Complications of phakic IOLs have been extensively studied and are unique depending upon their anatomical location inside the eye [10]. Anterior chamber pIOLs are associated with risks such as chronic endothelial cell loss, secondary glaucomas, pigment dispersion etc, whereas main issues with posterior chamber pIOLs are low or inadequate vault leading to anterior sub capsular cataract, high vault or oversized pIOL leading to angle closure glaucoma and rarely dislocation of the lens into the vitreous [10-16]. Short term complications such as IOP spikes and steroid response seen in early postoperative period are treatable and do not lead to visually significant sequelae, whereas long term complications such as cataract, glaucoma, corneal decompensation seen in late postoperative course may be visually significant and severe enough necessitating the explantation of the pIOL . Long term studies have generally found these lenses to be efficacious and safe[17,18].

Here we present a case report of TIPCL spontaneous rotation in a post traumatic eye.

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Case report:

A 35/M presented to our clinic with decreased vision OU (OD>>OS). There was h/o trauma with firecracker 14 years ago. His UCVA was 5/60 and 6/24 in OD and OS respectively while BCVA was 6/9 (-7.00D sph/ -3.00D cyl @ 70°) and 6/6 (-1.00D sph/-1.00D cyl@135°) in OD and OS respectively. We planned for implanting TIPCL in OD. Anterior segment and fundus examination was unremarkable. Pre-operative evaluation:

	OD	OS
ACD (mm)	3.96	3.79
Axial length (mm)	28.58	25.34
W-W diameter (mm)	11.49	

Details of Toric IPCL: Cylinder: 3.0 Length: 12.50 Power: -9.50 Optical diameter: 6.20

Surgery was uneventful and post operatively topical antibiotic- steroid combination and cycloplegics were given. On 1 week post op follow up BCVA in OD was 6/6 with correction of -0.75cyl@170°. Steroid was tapered and patient was called after 3 weeks. Patient came after 2 weeks with decreased vision in OD. His BCVA was 6/18 with correction of +1.00D sph/-4.00D cyl @50°. Toric IPCL was rotated by 45° so repositioning was planned (Fig 1). Vision improved to 6/6 with correction of -0.75D cyl @140°. Patient was advised post op medications and was asked to review after 3 months.

On follow up after 3 months again his Toric IPCL was found rotated by 50° (Fig 2) and repositioning was done. But again after few weeks Toric IPCL rotated. So now we planned for removal of TIPCL and clear lens extraction with IOL (Tecnis-1, +9.00D) implantation. Post operatively BCVA was 6/6 and N6 with -1.00 D cyl@70° and near addition of +2.50D.

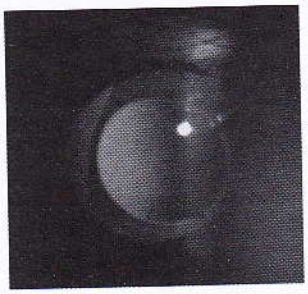

Fig 1: Spontaneous rotation (45°) after 2 weeks of surgery

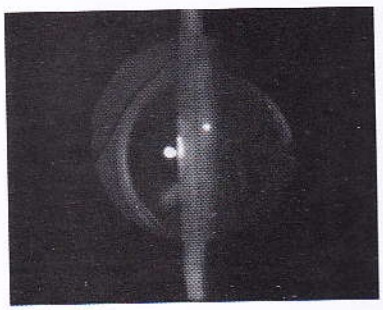

Fig 2: Spontaneous rotation (50°) after 3 months of surgery

Discussion:

The most popular method of determining ICL size involves predicting sulcus diameter using the horizontal white to white (WTW) distance, which can be measured manually with calipers or automated devices like Orbscan topography system, IOL Master and AS-OCT [19]. However, it has been observed that there is no correlation between WTW and sulcus diameter [20-22]. Ultrasound biomicroscopy (UBM) has been validated for ciliary sulcus diameter measurement and has been shown to be more accurate for assessment of the same [23]. Reinstein., et al. have recently evaluated the usefulness of very high frequency UBM (Artemis II, Ultralink, LLC) as a tool for accurate sulcus to sulcus diameter estimation [20]. It may also be helpful in measuring sulcus diameter in both horizontal and vertical axis. It has been demonstrated that most eyes have vertical sulcus diameter larger compared to horizontal [23]. Hence, it may be important to measure both diameters, especially in cases of toric ICLs with large fixation angle. Mori., et al. showed

that intraoperative fixation angle was highly correlated with rotation of TICL in postoperative period and they suggested that toric phakic IOL with minimum intraoperative fixation angle should be used to prevent postoperative rotation [24].

It is well accepted that a rotation in the cylinder axis of more than 30° is enough to decrease the optical effect and once again achieve 100% of the cylinder power[25–27]. Here we presented a case of Toric IPCL spontaneous rotation of 45° from its original surgical position 2 weeks after surgery and 50° rotation after 3 months of surgery. Our patient had a past history of trauma in his right eye which we thought could be the cause of unpredictable measurement of ACD and W-W diameter. We also planned to exchange the Toric IPCL with a larger diameter Toric IPCL as smaller Toric IPCL could be the cause of spontaneous rotation. But as the measurements were not very reliable and larger diameter Toric IPCL could rotate again so after discussing the risks and benefits of both the surgeries we planned for clear lens extraction and IOL implantation.

IPCL implantation has shown to be as effective as LASIK and surface ablation [28–30]. Although Toric IPCL is a safe, effective and excellent alternative in patients with myopic astigmatism, rotation can occur with time especially in post-traumatic cases. However, rotation can easily be solved by repositioning the Toric IPCL. The chances of rotation especially in post traumatic case should be borne in mind and explained to the patient so as to avoid future concerns of the patient.

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Acute Myeloid Leukemia with Bilateral Proptosis as the Sole Presenting Sign

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Abstract

Acute myeloid leukemia (AML) accounts for nearly 15% of all leukemias in children[1]. The leukemic cells can infiltrate any extramedullary site, tumorous accumulations within soft tissues and bones being labeled as granulocytic sarcomas. Granulocytic sarcoma (GS) or extramedullary leukemic deposits is an unusual manifestation of AML, accounting for about 3% of cases of AML . Bilateral proptosis is fairly common in association with acute and chronic lymphatic leukaemia, on the other hand myelogenous leukaemia rarely give rise to proptosis. Here we present a rare case of 4year old male child presenting as bilateral proptosis with no other manifestations of systemic malignancy at presentation. Radiological investigation, peripheral blood smear, bone marrow aspiration study was done for confirmation. The purpose of reporting such a rare entity is to highlight AML as a rare but important differential diagnosis of bilateral proptosis and emphasise the importance of peripheral blood smear in its diagnosis.
Keywords: Acute Myeloid Leukaemia; Proptosis, extramedullary deposits

Introduction-

Acute leukemias are the most common neoplasm seen in the paediatric population. In acute myeloid leukemia (AML),there is proliferation of malignant clones of immature myeloid cells,which replaces the bone marrow and invades other tissues of the body.[1] Primary orbital presentation without any evidence of systemic disease is only rarely seen in acute childhood leukemia and is typically due to chloroma.

Methodology

This case report highlights atypical presentation of AML in a paediatric patient . A four year old male child presented in eye department on March 2017 with proptosis in both eyes with low grade fever since 10 days. On examination, the child was irritable ,lean built weighing 7 kg and in severe agony , there was no lymphadenopathy and the vitals were stable except mild elevation in temperature.

On ocular examination the patient had severe and irreducible axial proptosis.which was tender on palpation ,there was marked fullness of both orbits,almost symmetrical with dilated vessels on upper eye lids,there was severe chemosis and cornea was exposed and dry. (Figure 1). Pupils were sluggish in reaction. Pressures were elevated in both eyes by digital tonometry and motility was extremely limited in all

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directions of gaze. Visual acuity could not assessed since the child was uncooperative . Fundus examination was not possible since cornea was hazy.

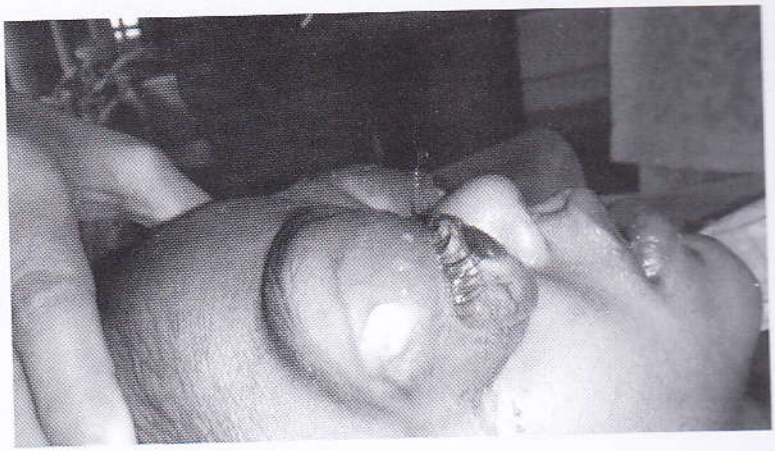

Figure-1

Provisional diagnosis was bilateral orbital cellulitis was made and child was refered to paediatric hospital and was started broad spectrum antibiotics and anti-inflammatory drugs but there was no response and proptosis continued to increase in the next few days.

Then complete blood count was done ,TLC-43,600 cell/cumm, Hb-8mg/dl,ESR-100mm/hr.MRI orbit reaveled lesion involving superior rectus,lateral rectus,bilateral lacrimal gland and the size of the lesion in right orbit was 46x37x22 mm and left orbit 39x31x20 mm and reported lymphomatous lesion/?pseudo tumour of orbits.

Based on the clinical findings and imaging study results, the differential diagnosis included lymphoma, metastatic neuroblastoma, and idiopathic orbital inflammation (inflammatory pseudotumor) and leukaemia were made.

After this peripheral blood smear for cell morphology was made and revealed moderately raised white blood cell count with a differential count of 30% segmented neutrophils, 20% lymphocytes, 6% monocytes, 4% promyelocytes, and 40%blast cells , which was strongly suggestive of leukaemia. thrombocytopenia was found. Following this peripheral blood picture a confirmatory bone marrow aspiration and biopsy was performed and bone marrow biopsy (Figure 2) showing myeloid series showing evidence of hyperplasia with presence of 40% blast cell.Erythroid series showing normal reaction (M:E=40:1) and diagnosis of AML was made.

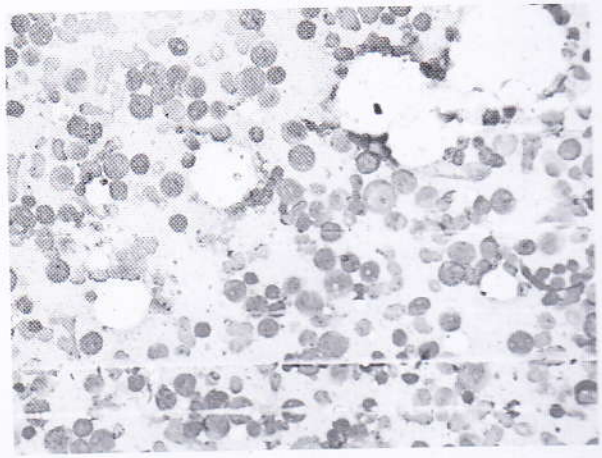

Figure -2

Since the diagnosis was confirmed by PBS and B.M biop sy,orbital tissue biopsy was foregone.

Once the diagnosis was established patients were referred to oncologist for further management and were not followed up by us.

Discussion

AML accounts for approximately15% of all leukemias in children.[1]Leukemic cells may infiltrate any extramedullary site. Granulocytic sarcoma is thought to originate in the bone marrow and the cells are believed to spread via the Haversian canals to collect in the subperiosteum and form a soft tissue mass[3].They more commonly affect the skeletal system, commonly the ligaments or periosteum. In cases with head and neck involvement they commonly affect the orbit or epidural space [6]. These tumors most commonly affect the skull,orbit, paranasal sinuses, spine, ribs, sacrum and sternum, involvement being related to the active hematopoeisis at these sites[3]. It can also involve the lymph nodes, skin and kidney [7]. This tumor can present prior to, concomitantly or even during remission of systemic leukemia[8].The presence of unilateral and bilateral proptosis has been reported with AML.[3,4] . the diagnosis of such tumor can be challenging especially when there are no signs of systemic leukemia. In the presence of systemic malignancy, a peripheral blood smear or a bone marrow biopsy may provide useful clues to the diagnosis.

Children with bilateral proptosis should always undergo systemic evaluation and blood investigations to rule out not only AML but other diseases as well apart from imaging studies because it is difficult to differentiate infective conditions and other malignancies even on CECT and MRI[2]

Peripheral smear is an invaluable ,non invasive,un expensive,very reliable tool in diagnosing of grave systemic form of AML.It shows immature blast cells with a high total leukocyte count and relative neutropenia. Leukemic proptosis, however, may not always be associated with leukocytosis or immature cells in the peripheral smear.

Doing a peripheral smear along with bone marrow aspirate and biopsy in all patients of AML manifesting with proptosis in the pediatric age is, therefore, justified.[5]
Although rare, in a child with the sudden onset of proptosis without any other systemic findings, the diagnosis of acute leukemia must be considered.

Conclusion-

Granulocytic sarcoma is a rare cause of childhood proptosis.When child present with rapidly growing orbital mass or orbilateral proptosis, AML should be kept in mind in differential diagnosis. For early diagnosis of AML, radiological imaging, peripheral blood smear along with bone marrow aspirate should be performed in all cases.If the diagnosis can be establish by a non invasive test like peripheral blood smear and one can avoid surgical intervention.
We report this case to increase the awareness of the pediatricians and oncologists regarding the unusual presentation of this rare neoplasm.

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Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil

Conflicts of interest There are no conflicts of interest.

Please find enclosed manuscript entitled,**"Acute myeloid leukemia with bilateral proptosis as the sole presenting sign"** for publication as an " case report" in your esteemed journal

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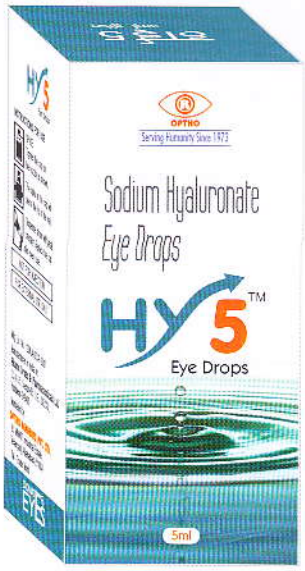

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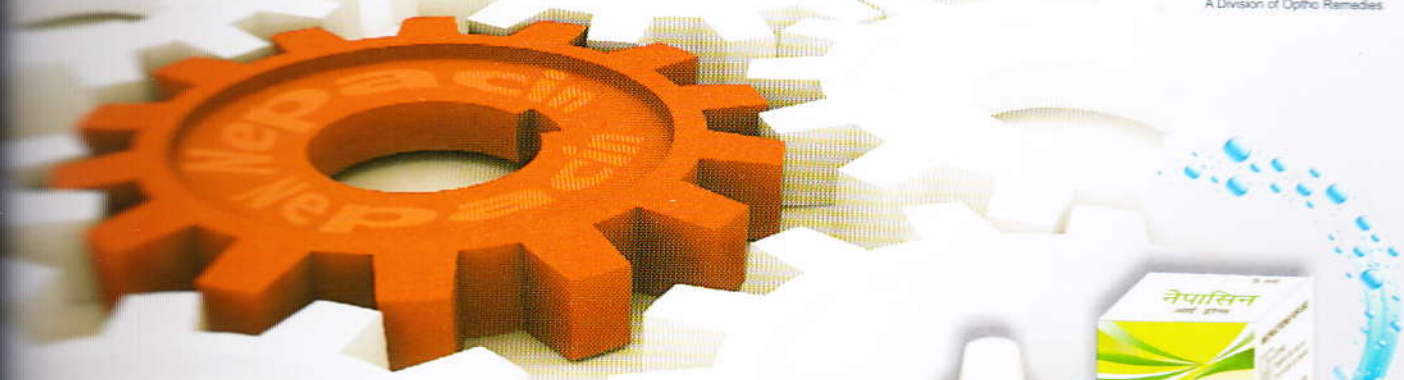

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Benzalkonium Chloride Sol.	0.01% v/v
Sterile Aqueous Vehicle	q.s.

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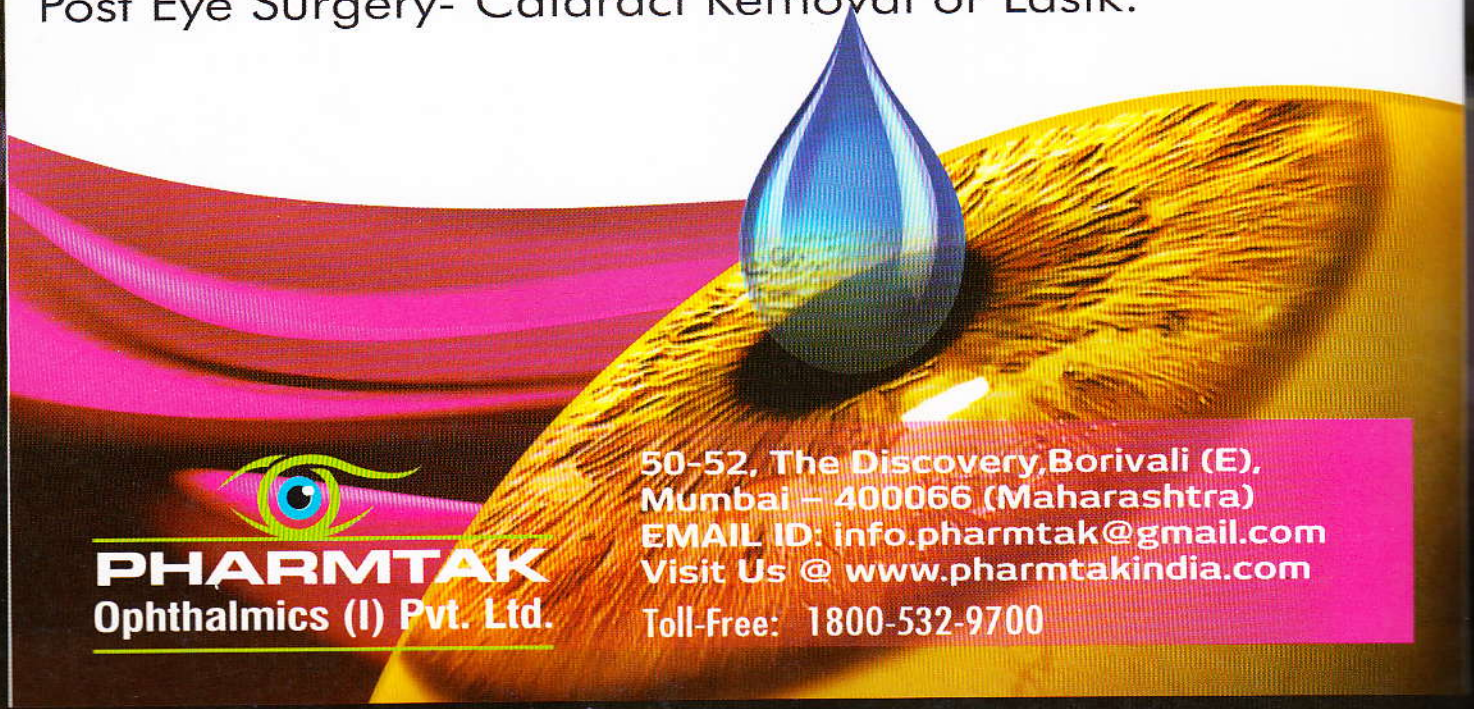
Dry eye and ocular surface damage, due to diseases such as:

Superficial Keratitis
Sjogren's Syndrome
Primary Dry Eye Syndrome
Post Eye Surgery- Cataract Removal or Lasik.



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