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Nd:YAG in the Treatment of Posterior Capsular Opacification: A study in A Tertiary Care Centre

Rasna Sharma

Abstract

Introduction: One of the most common complications of a cataract surgery is the Posterior Capsular Opacification. In the past, the treatment of PCOs was done surgically by making a small opening in the posterior capsule. Nd. YAG laser treatment causes photo disruption at a very high energy levels thereby disintegrating tissues. *Materials and Methods:* 140 patients ranging from 31 to 90 years of age with significant PCO, and complaining of gradual diminution of vision after a period of appreciably good vision following successful cataract extraction surgery were included in the study. After regular physical and clinical examination and visual acuity exam by Snellen's test, confirmation was done by slit lamp method. With the help of the slit lamp, the optical beam was focuses on the posterior capsule and the laser shots were given. Lowest energy of 1.0 mJ was used initially and was increased as and when required. *Results:* The predominant age group affected was between 51 to 70 years of age. It took 6-12 months in most of the cases for the PCO to form after the cataract surgery (31.43%). For mild opacification, laser power setting was between 1-2mJ for most of the patients, For moderate opacifcation, >2 – 3mJ was required and for severe, requirement was >3-5 mJ. the visual acuity of the patients improved to a large extent. 6/6 -6/12 improvement was seen in 82 (58.57%) of the patients, while 46 patients (32.85%) had an improvement to 6/18-6/24. Out of the complications observer among the patients, the most common one was a rise in intraocular pressure by more than 5 mmHg which was seen in 22.14% patients. *Conclusion:* Nd:YAG laser capsulotomy as a good and successful treatment of PCO. It is one of the recent, non invasive and effective mode of treatment for PCO with least amount of complications and no hospitalization.

Keywords: Cataract surgery; Posterior Capsular Opacification; Neodymium Yttrium Aluminium-Garnet.

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Introduction

One of the most common complication of a cataract surgery is the Posterior Capsular Opacification (PCO). It mainly results from the proliferation and the migration of residual lenticular epithelial cells [1-3]. Earlier studies have indicated that PCO occurs due to the result of the formation of opaque secondary membranes by active lens epithelial cells into fibroblasts with contractile elements and collagen deposition[4,5]. PCO is also said to result from the deposition of fibrin and other cell types into the posterior capsule during surgery or postoperatively [1].

It is estimated that the overall incidence of PCO is about 50% by 5 years of the cataract surgery [6-8]. It is said to occur in younger patients due to the higher cell proliferation rate [9]. This results on a decrease in the visual acuity and contrast sensitivity due to glare [10,11]. There was a difference on the rate of incidence of the PCO with different Intra Ocular lenses used. It was found that with silicone lenses, the rate of opacification was 27.9% while with polymethylmethacrylate (PMMA) lenses it was 7% [12].

In the past, the treatment of PCOs were done surgically by making a small opening in the posterior capsule. However, with the advent of Neodymium Yttrium Aluminium-Garnet (Nd. YAG) has changed it all. It has revolutionalized

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the management of PCO. Nd:YAG laser treatment causes photodisruption at a very high energy levels thereby disintegrating tissues [13,14]. Today, it is one of the most widely used tool with a fundamental output of 1064 nm in the Infra red range. Nd:YAG is used to make a hole in the clouded back lining of the lens capsule (posterior capsule) to allow the light to pass through the membranes to the retina at the back of the eye.

This procedure is done in the outpatient ward itself and lasts only about 3-5 minutes. The patient is normally free to leave immediately after the procedure and many times is able to observe an immediate improvement in the vision.

This study was therefore performed to assess the effects on the visual acuity following ND:YAG laser capsulotomy, as well as the total laser energy required for the same among the patients in our area.

Materials and Methods

This study was performed in the outpatient Department of Ophthalmology in Mallereddy Medical College for Women during the period of of 2 years 4 months ie from June 2015 to Sep 2017. 140 patients ranging from 31 to 90 years of age with significant PCO, and complaining of gradual diminution of vision after a period of appreciably good vision following successful cataract extraction surgery were included in the study. Patients who did not gain good vision following a previous cataract surgery, those who had decreased visual acuity due to any other ocular or systemic pathology such as granulomas, corneal opacity etc were excluded from the study. Patients with posterior segmental disorders were also excluded from the study. All the selected patients underwent Nd:YAG laser posterior capsulotomy.

Complete demographic details were collected from the and chief complaints of the patients such as the duration and the progression of he diminution of vision, time between the cataract surgery and the present complaint, the time duration of the good vision etc were considered carefully and noted. History of glaucoma, and other diseases like hypertension and diabetes were also acquired.

Complete physical and clinical examination was performed for all the patients. Visual acuity test with Snellen test and Jegger's test were performed before torch examination for the assessment of palpebral aperture, lids, conjunctiva, sclera, cornea, anterior chamber, iris, pupil and intraocular lens and posterior capsule status. Confirmation of this test was done by slit lamp method. Refraction of both the eyes, fundus examination and Schiotz tonometry was done for both the eyes for all the patients.

The procedure was thoroughly explained to the patients as well as their relatives and an informed consent was taken from all of them. The pupil was then dialated with topical 1% Tropicamide and 10% phenylephrine. Just before the procedure, 1% topical Apraclonidine was instilled. The eye was the anaesthesised using 4% lignicaine drops. With the help of the slit lamp, the optical beam was focuses on the posterior capsule and the laser shots were given. As the Nd:YAG produces invisible infrared rays, an inbuilt orange-red He-Ne beam outlines the infra-red rays and helps in focusing it on or slightly behind the posterior capsule. Lowest energy of 1.0 mJ was used initially and was increased as and when required. The first shot was given as close to the visual axis as possible and was extended in a crucial manner. Post capsulotomy, one drop of the same antiglaucoma medicine which was given at the start of the procedure was instilled. Topical non-steroid anti-inflammatory medication was advised 4 times a day for 7 days following the procedure. Post procedure, evaluation was done at 1 hour, 24 hours, 1 week and 2 weeks, after which, glasses were prescribed. Further follow up was done after month and 6 month interval. 1% Apraclonidine hydrochloride eye drops, twic daily and Flurbiprofen eye drops 4 times daily for 7 days was prescribed. If Intra ocular pressure was found to be more than 5 mm HG, than its base line reading, Tablet Acetazolamide 20 mg was advised.

Results

Out of the 140 patients, most of the patients belonged to the 51-60 years age group (41.43%) followed by 27.14% in 61-70 years. 81-90 year age group had the least incidence of cases (1.67%). Females were a more dominant group (52.86%) compared to the males (47.14%), with the male to female ratio being 1:1.12. (Table 1).

Table 1: Age wise distribution of the patients

Age Group	Males	% age	Females	% age	Total	% age
31-40	4	2.85	6	4.29	10	7.14
41-50	6	4.28	10	7.15	16	11.43
51-60	26	18.58	32	22.85	58	41.43
61-70	20	14.28	18	12.86	38	27.14
71-80	10	7.15	6	4.28	16	11.43

>81	00	00	2	1.43	2	1.43

It took 6-12 months in most of the cases for the PCO to form after the cataract surgery (31.43%) followed by 12-18 months in 24.29 cases. In 5.71% of the cases, it took 3-5 years (Fig. 1). The mean time interval for the development of PCO after the cataract surgery was found to be 16.28 months.

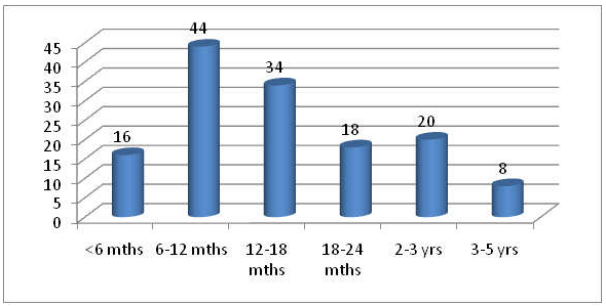

Fig. 1: Time interval between cataract surgery and PCO

Most of the PCO patients had fibrosis as the chief capsular opacification (47.14%), followed by mixture of Elsching's pearls and fibrosis (32.86%) (Fig. 2).

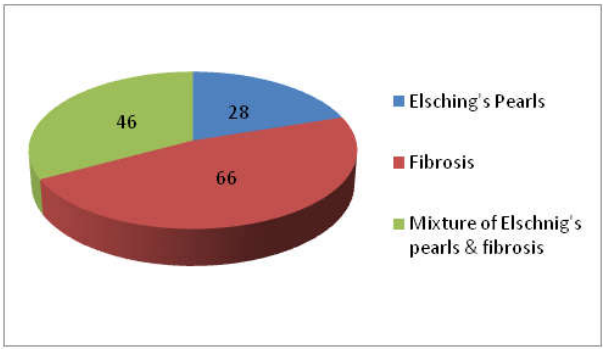

Fig. 2: Type of Posterior Capsular Opacification

Upon grading, the PCO was divided into mild, moderate and severe according to the visual acuity. Out of these the most common type was moderate (47.14%), closely followed by severe in 42.86% of the patients. Mild type of PCO was seen only in 10% of the cases (Table 2).

Table 2: Grading of PCO according to Visual Acuity

Grade	Number	Percentage
Mild (VA: 6/18 -6/24)	14	10
Moderate (VA: 6/36 -6/60)	66	47.14
Severe (VA: 6/60 -1/60)	60	42.86
Total	140	100

Among the 14 members who had mild opacification, initial laser power setting was between 1-2mJ for most of the patients. Out of the patients with moderate opacification, 30 patients had 1-2 mJ and 28 patients required >2–3mJ and the rest required >3-5 mJ. Among the patients with severe opacification, very few had 1-3mJ shots, while most of them required an energy level of >2-3 mJ (Table 3).

Table 3: Laser power setting for categories of PCO

Type of PCO	1-2 mJ	>2-3 mJ	>3-5 mJ	>5-7 mJ
Mild	11	3	0	0
Moderate	30	29	7	0
Severe	5	42	13	0
Total	46	74	20	0

Post laser, the visual acuity of the patients improved to a large extent. 6/6 -6/12 improvement was seen in 82 (58.57%) of the patients, while 46 patients (32.85%) had an improvement to 6/18-6/24 (Table 4).

Table 4: Post laser best corrected Snellen acuity

Post laser Snellen acuity	No of patients	Percentage
6/6 – 6/12	82	58.57
6/18 – 6/24	46	32.85
6/36 – 6/60	6	4.29
No improvement	6	4.29

Out of the complications observer among the patients, the most common one was a rise in intraocular pressure by more than 5 mmHg which was seen in 31 patients (22.14%). These occurred as spikes which reduced to the base line level within 24 hours. In most cases they returned to normal in 4 hours itself. Glare was another complication which was seen in 5 patients (Fig. 3).

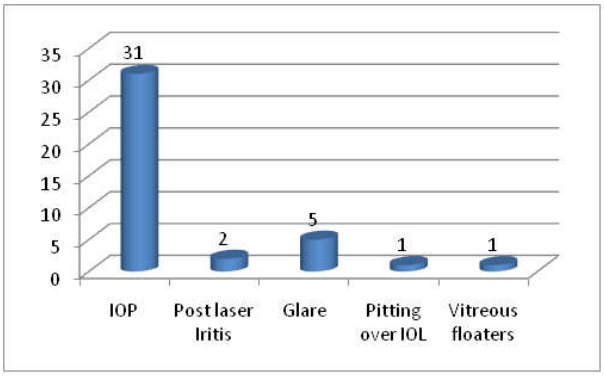

Fig. 3: Complications of Nd. YAG laser capsulotomy.

Discussion

Post operative opacification is one of the common occurrences in patients who have undergone

extracapsular extraction of senile cataracts. The incidence seems to be more common in youngsters compared to the elderly. The time required for the opacification also varies between patients and may range from few months to years.

Nd:YAG laser capsulotomy is a non invasive procedure which has shown immediate effect and improvement in the visual acuity. Few studies have shown the effects of the size capsulotomy and the energy levels required.

The most dominant age group in our study to be affected was 51-60 years followed by 61-70 years. The rate of opacification was found to be more among the younger patients rather than the older ones, with more patients below 60 years being affected than above it. This was in concordance with another study by Emery et al, who also stated that the rate of opacification declined with age [1,15]. However, Westling et al and Calissendorff et al found no relation between the age and sex of the patients. The probable reason for the high rates of PCO in this age could be due to the increase cataract surgeries which are common in this age group [16].

The occurrence of PCO after the cataract surgery was the most between 6-12 months. In different studies, the time intervals were different, and varied from months to years [17]. Emery et al observed 28% of the patients to have PCO after 3-5 years of surgery [15], while Sinskey and Cain reported 43% of the patients having PCO after 3 months to 4 years of cataract surgery [18].

The most common type of PCO in the present study was fibrosis which was followed by a mixture of fibrosis and Elschnig's pearls. Elschnig's pearls, one, without combination was seen in very few patients in our study. Our study was corroborated by Nicula et al. [19], who also stated that fibrosis was the most common type of PCO observed and seen in 86% of the cases.

As early as 1986, Auffarth et al. [20] analyzed the energy levels for Nd:YAG capsulotomy and concluded that different ocular conditions of the anterior and the posterior segment showed a different profile for capsulotomy and laser repetition. They also concluded that the total energy requirement for capsulotomy was 12.7±9.4 mJ.

In the present study, the visual acuity was 6/6 -6/12 in most of the cases post treatment (59%) with improvement seen in all the eyes except for 4 (4.2%). Similar case was observed in a study by Patil et al., where in 100% improvement was observed in the vision of all the eyes with 67% of the patients having visual acuity of 6/9 [21]. In a study by Clark et al., 98% improvement was observed with a vision improvement in 84% of the cases [22].

The most common complication observed in the present study was an increase in the intraocular pressure (IOP) seen in 31 cases. The rise in the IOP was maximum between 1-3 hours after the procedure, which declines within 24 hours and resolves in a few days. In a similar study by Patil et al., 7% of the patients were observed with IOP, which was the most common complication [21].

Conclusion

Nd:YAG laser capsulotomy as a good and successful treatment of PCO. It is one of the recent, non invasive and effective mode of treatment for PCO with least amount of complications and no hospitalization. This can be used regularly fo the treatment of PCO, instead f the other conventional methods.

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Original Article

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A Comparative Study of Colour Vision Assessment by Ishihara Charts and Roth 28 Hue Test in Optic Nerve Disorders

R. Sudha[1], Praveen Kumar K.V.[2]

Abstract

Introduction: Colour vision tests that were originally intended for the study of congenital dyschromatopsias produce confusing results when applied to patients with acquired diseases. Ishihara test plates primarily designed for detecting congenital dyschromatopsias, are widely used to detect acquired colour vision defects because of their convenience, apparent simplicity of administration and availability. This study was done to compare the results of Ishihara's test and Roth 28 hue test in identifying and quantification of colour vision abnormalities in Optic Nerve disorders and to establish patterns of colour vision defects in acquired optic Nerve disorders. *Materials and methods:* This was prospective, cross sectional, comparative study done on patients with various optic nerve disorders attending the OPD from January 2016 to December 2018 were included. 71 patients of various optic neuropathies were included. All patients underwent comprehensive ophthalmic examination including visual acuity assessment, slit lamp examination, fundus examination, and IOP measurement. Colour vision was tested mono-ocularly with Ishihara's test and Roth 28 Hue test. All the data was tabulated and statistically analysed. *Results:* The study included 139 eyes of 71 patients with various optic neuropathies. The mean age was 36 years. The causes of optic neuropathies included were papilledema, optic neuritis, optic atrophy, glaucomatous optic neuropathy, and tobacco-alcohol amblyopia. Two patients had Traumatic optic neuropathy and one patient had non-arteritic ischaemic optic neuropathy. On comparing Ishihara and Roth test, there was statistically significant correlation between two tests ($p<0.001$). On comparing BCVA with both the test results, statistically significant correlation was found. (Ishihara: $p=0.001$, Roth: $p<0.001$). *Conclusion:* Even though Ishihara's test was designed to screen congenital colour vision defects, our study shows that it can be still used to detect colour vision abnormalities in acquired colour vision defects such as optic neuropathies because the results are comparable to arrangement test such as Roth test.

Keywords: Colour Vision, Ishihara and Roth Test, Optic Nerve Disorders.

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Introduction

Colour vision helps us to discriminate a light stimulus as a function of its wavelength. The physical effects of light, objects on interaction with each other combined with the physiological response of the eye to light and psychological context of colour perception together produce perception of the surrounding environment [1].

The light-sensitive cone photoreceptor cells in the retina and the neural components that process information about wavelength gathered by the photoreceptors helps in the colour vision. Kollner et al. reported that patients with retinal diseases present with blue - yellow defects, where as optic nerve disorders present with red-green colour blindness and in some cases, there can be nonspecific defects [2].

Acquired colour vision defects occur in toxic, vascular, inflammatory, neoplastic, demyelinating and degenerative disorders of optic nerve, retinal diseases and diseases of visual cortex. The damage caused in these disorders is usually nonselective, and the patterns of defects are usually different

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from those seen in congenital colour vision abnormalities. Hence, tests that are used in the diagnosis of congenital dyschromatopsia produce conflicting results in patients with acquired colour vision defects [3].

Ishihara test plates are widely used to detect colour vision defects because of their ease of administration [4]. The major disadvantages of Ishihara test is that, they do not contain designs for detecting tritan defects, and that good visual acuity is needed for performing the test. Hence Ishihara test is not appropriate for the assessment of a majority of acquired colour vision defects, which are usually associated with tritan type of defects [2].

Other colour vision tests such as Farnsworth Munsell 100 Hue test (FM 100 Hue Test), Roth 28 hue test can be used to estimate both the type and extent of colour vision defects. Error score in Roth 28 hue is comparable to that of 100 hue test and can be used as an alternative to FM100 hue testing to quantitatively assess colour vision, can be performed quickly and useful for follow up also [5].

The present study was done to compare the Ishihara's test and Roth 28 hue test in identifying and quantification of colour vision defects and to establish their patterns in acquired disorders of the optic nerve. A thorough review of literature has shown no studies comparing the two tests in acquired colour vision defects and hence the present study was planned.

Materials and Methods

This was a prospective, cross sectional, comparitive study done in patients with acquired optic nerve disorders attending ophthalmology OPD of tertiary care centre from January 2016 to December 2017. A total of 71 cases with acquired optic nerve disorders like Optic neuritis, Optic atrophy, Traumatic optic neuropathy, Drug induced optic neuropathy, Ischemic Optic Neuropathy were included in the study. Patients with age less than 10 years and more than 65 years, macular disorders, visual acuity less than 6/18 were excluded from the study as these cases have colour vision defects.

Informed written consent was taken from all the patients and ethical committee approval was obtained. Detailed history including demographics, ocular disease, past medical illness, drug history and personal history was taken from all the patients. All patients underwent detailed ophthalmic examination which included best corrected visual acuity by ETDRS Chart, contrast sensitivity by Pelli Robson chart, and dilated funduscopy to assess the condition of the optic nerve. Colour vision was assessed monocularly with Ishihara test plates and Roth 28 hue test with appropriate near vision correction. In Ishihara test, the plates were held at a distance of 75 cm and tilted so that the plane of the paper is at right angles to the line of vision. The numerals which are seen on plates 1-25 are stated and each response was to be given in three seconds. If the subject was unable to read the numerals, plates 26-38 were used and the winding lines between two x's were traced. Each tracing was to be completed within 10 seconds. If more than 17 plates were read normally, the colour vision was recorded as normal. If less than 13 plates were read, colour vision was graded as severe colour vision defect, if 14 to 16 plates were read, as moderate colour vision defect.

Roth 28 Hue test was conducted was conducted on a black background under day light at a distance of 50 cm. The cap number 82 was the reference cap and it was considered as the starting and end point of the test. The patients were instructed to arrange the remaining 27 caps, by selecting a cap closest in colour to the previously arranged cap and placing them in a circular sequence, without any time limit. The score was calculated by reading colour cap numbers on the reverse side of the case and the score sheet was plotted. For each of 28 caps difference of the cap number from numbers of the adjacent caps was calculated (value x). Values x and 84 (= (82-1) +3)-x was then compared and lower was chosen as distance. The shortest distance was then calculated which was taken as corrected x. Values of distance on both sides was added and then 6 was subtracted. The resulting value was noted as local error score sum of which was taken as global error score [6].

Qualitative interpretation of the test was done by plotting the score sheet. The result was considered normal when the lines remained outside the circle. The type of the colour vision defect was determined by comparing the crossover lines to see if they were parallel to protan, deutan and tritan colour confusion axes. In case of multiple crossover lines which were not parallel to any axis, was considered as a nonspecific colour vision defect.

Chi-square test was done to study the correlation between two qualitative variables. The Kruskal-Wallis test was done to study the correlation between quantitative variables and qualitative variables. All tests were done using SPSS version 16 with p value less than 0.05 considered to be significant.

Results

The study included 139 eyes of 71 patients with acquired optic nerve disorders. The age of the patients ranged from 11 years to 64 years with a mean of 36.51±14.79 years. Out of 71 patients in the study, 35 (49.30%) were males and 36 (50.70%) were females. Out of the optic nerve disorders included in the study, papilledema was seen in 47 eyes (34%), optic neuritis in 21 eyes (15%), optic atrophy in 20 eyes (14%), glaucomatous optic neuropathy in 18 eyes (13%), tobacco-alcohol amblyopia in 10 eyes (7%), traumatic optic neuropathy in 2 patients (2%) and one patient had non arteritic ischaemic optic neuropathy. Other conditions included in the study were grade 4 hypertensive retinopathy in 1 patient, diabetic papillopathy in 1 patient, disc edema secondary to orbital pseudotumour in 2 patients and disc edema due to orbital lymphoma in 1 patient.

Out of 71 patients in the study, systemic disease was found in 44 patients. Papilledema due to cerebral venous thrombosis (CVT) was found in 10 patients and Idiopathic Intracranial Hypertension (IIH) was found in 12 patients. Meningitis was found in three patients. Optic neuropathy secondary to intracranial mass lesions were found in 8 patients, one patient had pineal gland tumour and one patient had craniopharyngioma. Optic neuritis due to demyelinating disease was found in 4 patients.

On Roth 28 hue test, out of 139 eyes, 91 (65.46%) eyes had normal colour vision and 48 (34.53%) eyes had colour vision defects. Out of 48 eyes, 2 eyes (1.43%) had protan defects, 6 eyes (4.31%) had duetan defects and 22 eyes (15.82%) had tritan defects and 18 eyes (12.94%) had diffuse nonspecific chromatic loss. On Ishihara test, normal colour vision was found in 91 (65.46%)eyes and 48 (34.53%) eyes had colour vision defects. Out of 48 eyes, 16 eyes (11.51%) had moderate colour vision defect, 15 eyes (10.79%) had severe colour vision defects, 17 eyes (12.23%) were not able to read any of the plates.

Ishihara Vs Roth 28 Hue Qualitative analysis (Table 1)

On comparing results of Roth 28 Hue test and Ishihara test, 74 eyes had normal colour vision by both the tests and the correlation between the two tests was statistically significant (p<0.001). On Ishihara's test, 91 eyes had normal colour vision. Of these 91 eyes, on Roth testing, only 74 eyes showed normal colour vision and 17 eyes had colour vision defects. Out of 17 eyes with colour vision defects, 9 had severe colour vision defect and 8 eyes showed colour pattern defects. On the other hand, on Roth test 91 eyes showed normal colour vision out of which only 74 eyes showed normal colour vision by Ishihara's test. Remaining 14 eyes showed severe colour vision defect and 3 showed moderate defects by Ishihara's test. Severe colour vision defect was detected in 32 eyes by Ishihara's test. Of these 32 eyes on Roth test, only 4 eyes were detected to have nonspecific colour vision defect (severe); 14 eyes had normal colour vision and 14 eyes showed a pattern abnormality. Roth test showed a tendency towards detecting more pattern abnormalities, with 30/139 showing different colour patterns.

Table 1: Roth 28 Hue Test Vs Ishihara test-Cross tabulation (Qualitative)

		Ishihara			Total	Pearson- Chi square value 36.10 p<0.001
		Severe CV defect	Moderate CV defect	Normal C V		36.10 P<0.001
Roth	Nonspecific	4	5	9	18	
	Patterns	14	8	8	30	
	Normal	14	3	74	91	
Total		32	16	91	139	

Table 2: Correlation of colour vision using Ishihara's test and Global error score on Roth 28-hue test.

		Roth 28 Hue test-Global Error Score		
		Median	Inter quartile distance	
Ishihara Test	Severe CV defect	282	630	Pearson-Chi square Value 14.81
	Moderate CV defect	264	582	
	normal	0	120	p<0.001

Ishihara Vs Roth 28 hue Quantitative analysis (Table 2)

Increased Global error score was associated with severe colour vision defect by Ishihara test and this correlation was statistically significant (p<0.001). The median global error score was 282 (680) with severe color vision defects, with moderate colour vision defect was 264 (582), and in normal colour vision the score was 0 (120)

Comparison of BCVA with Roth 28 hue test (Fig. 1)

Severe colour vision defect by Roth test was correlated with the least median Log MAR BCVA of 0.20 (0.30), moderate colour vision defect was correlated with median Logmar BCVA of 0.20 (0.50) and normal colour vision by Roth test with a median Logmar BCVA of 0 (0.20).

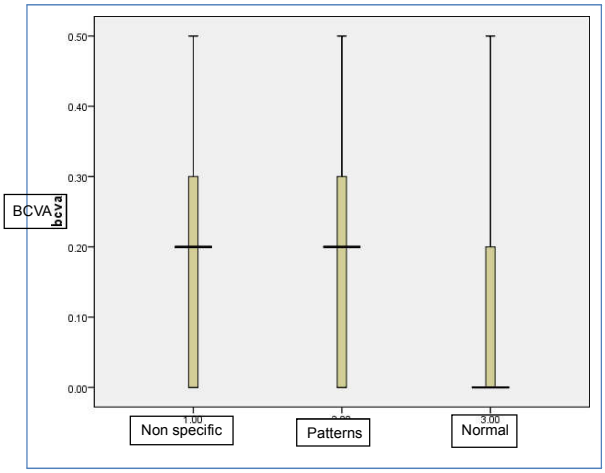

Fig. 1: Comparison of BCVA with Roth 28 hue test

Comparison of BCVA with Ishihara test (Fig. 2)

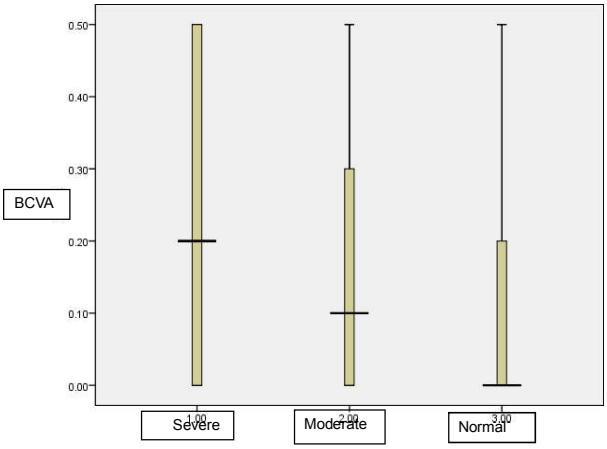

Fig. 2: Comparison of BCVA with Ishihara test

Statistically significant correlation was found between BCVA and severity of colour vision defects (p=0.001). Severe colour vision defect was associated with the poorest BCVA, with median BCVA of 0.20 (0.05), while moderate colour vision defect had a median BCVA of 0.10 (0.03) and normal colour vision had a median BCVA of zero (0.20)

Comparison of Colour Vision Test Results and Presence of RAPD

Statistically significant correlation was found between RAPD and severity of colour vision defect on both Ishihara (p=0.001) and Roth 28 hue tests (p< 0.001)

Patterns of Colour Vision Defects in Optic Neuritis

In the present study, 34% of the eyes with optic neuritis had tritan defects and 6% had Deutan defects. 30 % of the eyes showed nonspecific colour vision loss. 30% of the cases of optic neuritis showed normal colour vision and good visual acuity on resolution.

Patterns of Colour Vision Defects in Papilledema

80% of the eyes with papilledema had normal colour vision whereas 11% eyes had tritan defects, 5% had deutan defects, 4% had nonspecific colour vision defects.

Patterns of Colour Vision Defects in Optic Atrophy

44% of the eyes with optic atrophy had normal colour vision and had good visual acuity. Other colour vision defects noted in these patients were tritan defects (28%), deutan (11%) and nonspecific colour vision defects (17%).

Discussion

Most of the patients in the study were in age group of 20-60 years. Papilledema due to cerebral venous thrombosis (CVT) was found in 10 patients and Idiopathic Intracranial Hypertension (IIH) was found in 12 patients. Infections like pyogenic meningitis were found in one patient and rickettsial meningitis was found in one patient. Pituitary adenoma was found in 8 patients, one patient had pineal gland tumour and one patient had craniopharyngioma. Optic neuritis secondary to demyelinating disease was found in 4 patients.

On correlation of BCVA with Ishihara test results, severe colour vision defect was associated with the poorest BCVA, with median Log MAR BCVA

of 0.20 (0.05), while moderate colour vision defect by Ishihara test had a median LogMAR BCVA of 0.10 (0.03) and normal colour vision by Ishihara test had a median Log MAR BCVA of zero (0.20). The correlation between BCVA and severity of colour vision defects was statistically significant (p=0.001). The study also found that Ishihara's test requires better acuity for good resolution. The results were in accordance with a study by Almog Y et al., who correlated visual acuity with colour vision on Isihara's test and found that colour vision defects correlates well with best corrected visual acuity. They also concluded that for the same degree of vision loss, patients with optic neuropathy are most likely and patients with amblyopia are least likely to have a significant colour vision defect [7].

On comparing BCVA with Roth test results, severe colour vision defect by Roth test was associated with the least median Log MAR BCVA of 0.20 (0.30), moderate colour vision defect with median Log MAR BCVA of 0.20 (0.50) and normal colour vision with a median Log MAR BCVA of 0 (0.20). Statistically significant correlation was found between severity of colour vision defects detected by Roth test and BCVA (p= <0.002)

Mc Culley et al in their study compared colour vision results of Ishihara, Farnsworth D-15 panel and HRR plates with visual acuity in 12 normal individuals and found that the results with Ishihara test were most dependent and Farnsworth D-15 test were least dependent on visual acuity. The differences between the results of the two tests are multi-factorial. Ishihara test has 21 characters to be recognized where as arrangement tests are based on identifying a given object. The size of test object also correlates with visual acuity, as Ishihara characters differ in width with the thinnest portions being less than 0.5cm and caps of arrangement tests having a diameter of 1 cm [8].

In our study, 34% of the eyes with optic neuritis showed tritan defects and 6% had deutan defects and 30% of the eyes showed nonspecific defects. 30% of the resolved cases had normal colour vision and had good visual acuity. Our findings were in concurrence with the findings of Optic Neuritis Treatment Trial which detected mixed red- green defects in 29.6% patients and tritan defects in 40.8% patients. The study found that blue- yellow defects were more common in acute phase and red- green defects were seen at 6 months followup. The study also concluded that optic neuritis always will not always result in selective red- green deficits and the type of the defect cannot be used in the diagnosis of optic neuritis [9].

In our study, 80% of eyes with papilledema had normal colour vision, 11% had tritan defects, 5% had nonspecific colour vision loss and 4% had deutan defects. Hart W M et al in their study had similar findings and concluded that chronic papilledema causes mild to moderate confusion of blue-yellow hues with a lesser degree of impairment of red green discrimination [9].

In the present study, 44% of eyes with optic atrophy showed normal colour vision and also had good visual acuity. Tritan defects were found in 28% of the eyes, 11% had deutan defects and 17% had nonspecific colour vision loss. According to Hart W M et al optic nerve disorders especially those involving papillo-macular bundle are most frequently associated with central scotomas that impair visual acuity and are associated with red-green defects. Optic nerve disorders resulting in arcuate or peripheral field defects are associated with relatively good visual acuity and result in selective blue- yellow defects [9].

RAPD was found in 15 eyes (10.79%) in the study. Out of them, 10 eyes had pattern abnormalities on Roth test and 5 eyes had normal colour perception. On Ishihara's testing, 9 eyes had severe colour vision defect, 2 eyes had moderate colour vision defect and 4 eyes had normal colour vision.

On comparision of Roth 28 Hue test and Ishihara tests, 91 eyes were found to have normal colour vision by both the tests. However, only in 74 eyes there was concordance between the two tests. The concordance between the two tests was higher when visual acuity was normal. There was statistically significant correlation between the two tests (p<0.001).

On Ishihara's test 91 eyes showed normal colour vision. Of these 91 eyes on Roth testing, only 74 eyes showed normal colour vision and 17 eyes had abnormal colour vision; 9 had severe colour vision defect and 8 eyes showed patterns. On the other hand, 91 out 139 eyes showed normal colour vision by Roth test, out of which only 74 eyes showed normal colour vision by Ishihara's test. Remaining 14 eyes showed severe colour vision defect and 3 showed moderate defects by Ishihara's test.

Severe colour vision defect was detected in 32 eyes by Ishihara's test. Of these 32 eyes, only 4 eyes were detected to have nonspecific colour vision defect (severe) by Roth test; 14 eyes had normal colour vision and 14 eyes showed a pattern abnormality. Roth test showed a tendency towards detecting more pattern abnormalities, with 30/139 showing different colour pattern abnormality. This

implies that Ishihara test overestimates defects of colour vision and also more severe colour vision defect is more likely to be detected by Ishihara's test as it requires finer visual acuity.

Global error score determined by Roth 28 Hue test was compared with Ishihara test and increasing values of global error score was associated with severe colour vision defect by Ishihara test and this correlation was statistically significant ($p<0.001$).

A thorough review of literature showed no studies comparing Roth 28 hue test with Ishihara's test in detecting colour vision defects in optic nerve disorders. However, there are studies which have compared colour vision abnormalities detected by different plate tests (such as HRR plates versus Ishihara's test) or by arrangement test (such as FM 100 hue test versus the shorter versions) .

Baron et al compared colour vision defects detected by HRR plates and Ishihara plates in patients of optic neuropathy and found that the receiver operating characteristics (ROC) curve was statistically significantly better on HRR test than for the Ishihara test ($p=0.0006$). The best specificity-sensitivity balance for the HRR was 100% and 79% respectively, and for the Ishihara test was 100% and 48% respectively. They concluded that the HRR test was superior to the Ishihara test in detecting acquired dyschromatopsia due to optic neuropathy which correlated with the present study [10].

Neitz M et al. found that nearly half of the people with normal colour vision tend to make errors on the Ishihara Plates. Most patients with colour vision defects fail to see the correct symbol in almost all the test plates and thus it is not possible to grade the severity of colour vision deficiency [5]. Hardy L G et al showed that, Ishihara test is rough screening method for red green defect. It is a gross test, fails to classify type of colour vision defect and cannot be used to give satisfactory evaluation of extent and degree of defect [3]. However, our study has shown that the two test results are comparable statistically ($p< 0.001$) and in 61.8% of eyes there was complete agreement in the test results obtained by two study tests. Hence, Ishihara's test can be used to detect acquired colour vision abnormalities when arrangement tests are not available.

Amos J F et al. concluded that Roth 28 Hue test is a good compromise between the ease and speed of D-15 and quantification of the 100 hue, because this test is based on established principles of FM 100 hue test. 11 According to Erb C et al., FM 100 hue test is too time consuming and difficult for both patient and ophthalmologist. On the other hand, screening tests such as Ishihara plates are quick and simple to use but colour discrimination cannot be quantitatively evaluated. Roth 28 hue test is reliable, sensitive and quick colour arrangement test. By presenting more colour caps than D -15 it allows greater expression of colour confusion and hence it is a good compromise between D-15 and 100-Hue test [5].

Nichols B E et al. evaluated significantly shorter version of FM 100 hue test in patients with optic neuritis, IIH and Grave's ophthalmopathy and found that a test consisting of chips 22-42 had nearly the same sensitivity and specificity as the entire test. This minimizes the time to one fourth of the original examination time [10].

In this study we have compared Ishihara's test with Roth test and found that it can be still used to detect acquired colour vision abnormalities although the test was designed for congenital colour vision defects. The results are also comparable to arrangement test such as Roth test.

Even though Ishihara's test was designed to screen congenital colour vision defects, our study shows that it can be still used to detect colour vision abnormalities in acquired colour vision defects because the results are comparable to arrangement test such as Roth test. Our study also showed that visual acuity correlates well with results of both the tests. Ishihara test showed a tendency to pick up severe colour vision loss while Roth test showed different pattern abnormalities. This difference among two tests may be because of the size of test types. We also found that, in contrary to common clinical belief, optic neuropathies do not always result in red-green colour vision defects. Patients with optic neuritis showed a greater tendency towards blue –yellow defect in the present study and resolved cases of optic neuritis had normal colour perception. Most of the patients with papilledema showed normal colour vision.

Conclusion

From this study we can conclude that Ishihara's test can still be used as an important clinical tool for evaluation of colour vision. Even though Ishihara's test was designed to screen congenital colour vision defects, our study shows that it can be still used to detect colour vision abnormalities in acquired colour vision defects such as optic neuropathies because the results are comparable to arrangement test such as Roth test.

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Original Article

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A Clinical Study of Association Between Serum Lipid Profile and Diabetic Retinopathy

R. Sudha

Abstract

Introduction: Diabetic retinopathy plays a main role in adult blindness. Early identification of diabetes mellitus and its risk factors will result in decreasing complications .The aim of this study is to identify the association between the lipid profile with the diabetic retinopathy severity.

Methods: This study comprises cases of 200 number type II diabetes mellitus (100 cases of diabetic retinopathy and 100 cases of normal fundus) and control with 100 number with age/sex matched were examined ophthalmologically. Fundus were dilated and examined with ophthalmoscopy and slit lamp biomicroscopy. Grading of severity of retinopathy calculated by ETDRS classification. Lipid profile analyzed using biochemical method.

Results: There was significant association between serum cholesterol level and diabetic retinopathy. Visual acuity was not affected.

Conclusions: Hypercholesterolemia may acts as one of the risk factor in diabetic retinopathy and also CSME.

Keywords: Hypercholesterolemia; Diabetic Retinopathy; Ophthalmoscopy.

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Introduction

Diabetes mellitus emerging highly epidemic in India, currently an approximate of 62 million individuals diagnosed [1,2]. According to WHO, diabetic retinopathy is responsible for 3-7% of the total blindness in Asia [3]. The prevalence of diabetic retinopathy in Indian population is apprximately 3.5% and incidence of diabetic retinopathy in diabetic population was 18.0% [6]. In a study by Wild et al., demonstrated that the incidance of diabetes mellitus will double from 171 million to 366 million in the year 2030 [4]. According to World Diabetes Atlas Indians were projected to have around 51 million diabetes mellitus population4. There is a growing concern for Asia being the region for diabetic epidemic [5,6]. Diabetic retinopathy is preventable microvascular complication, leading risk factor of blindness [7]. It is a microvasculopathy. Diabetes retinopathy is observed both in type I and II diabetes mellitus.

Duration of DM is the predominant and age of the patient are the important risk factor for diabetic retinopathy development and prognosis. Other risk factors will be control of blood sugars, hypertension, dyslipidemia, microalbuminuria, BMI, kidney disease and smoking habits are associated with diabetic retinopathy progression [8,9,10].

Diabetic retinopathy accompanied by lipid exudation also accumulation in the retina11. Elevated serum lipid levels may increases risk of retinal hard exudates in diabetic retinopathy patients, retinal hard exudates accompanies diabetic macular edema, resultant may increase the risk of visual impairment [12].

The association between lipid levels with diabetic retinopathy has been studied in few. Some studies

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shows serum triglyceride levels may have the role in progression of diabetic retinopathy. Whereas other studies showing no correlation [13].

The diabetic retinopathy treatment was laser photocoagulation when it cauases CSME or in severe NPDR. Medical management will beneficial with lipid lowering drugs. There is some anecdotal evidence of the effect of lipid lowering drugs in reducing hard exudetes [11].

Current study designed to analyze the correlation of serum lipid profile with diabetic retinopathy.

Methodology

Current study done in ophthalmology department from January 2016 to December 2016. 300 patients who attending the OPD were included. The patients were divided into three groups. 100 patients with diabetic retinopathy kept in study group and 100 diabetic patients without changes in retina kept as control. 100 subjects with age and sex matched healthy persons were included as controls. Type II diabetes mellitus of more than 5 years duration, on medications, Age more than 40 years were included in this study. Patients with significant hazy media impairing fundus evaluation, pupillary abnormalities which prevented adequate dilatation for funduscopy, Patients on hypolipidemic drugs, treated earlier with either LASER, Intravitreal anti-VEGF injections were not included.

Both cases and controls were underwent a detailed ophthalmic evaluation; slit-lamp examination, BCVA and recorded using Snellen chart, dilated fundus examined for diabetic retinopathy. Diabetic retinopathy changes were graded into five classes on the basis of ETDRS classification.

Lipid profile: 5ml of fasting blood sample collected and lipid profile analysed including serum fasting total cholesterol, fasting triglyceride, fasting low density lipoprotein, high density lipoprotein.

The data obtained was compared with the grades of diabetic retinopathy and its association with each of the three groups. All group data were presented as frequency distribution and the average values were presented as mean±SD for the normal distribution data. p value less than 0.05 kept as significant.

Results

In our current study, the mean age group1, 2 and 3 were 60.79±6.85, 57.96±6.07 and 61.05±7.45 years.

In this study, 53 were of males and 47 were females.

Table 1: Age, Duration of diabetes and treatment

		Group 1	Group 2	Group 3
Age (years)		60.79±6.85	57.96±6.07	61.05±7.45
Duration of diabetes (years)		9.25±4.46	6.24±1.29	-
Treatment modality	Oral hypoglycemic drug	75%	78%	-
	insulin	26%	21%	-

In this study duration of diabetic age ranged from 5 years to 25 years. The disease duration in group 1 and 2 observed as 9.25±4.46 and 6.24±1.29 years. Oral hypoglycemic drugs were being used in group 1 and 2 were by 75% and 78% (Table 1).

Cataract was the most common ocular association.

The percentage of subjects with normal anterior segment in group 1, 2 and 3 are 20.0%, 28.0% and 23. There were no significant changes in anterior segment features among different groups.

According to the present study some degree of visual impairment was seen in patients of Group 1. However there was no statistical significance with p=0.9.

In group 1, mild, moderate and severe NPDR retinopathy in 43%, 30% and 11% of patients respectively; very severe NPDR in 7% and proliferative retinopathy in 9% of patients.

Table 2: Mean values of lipid prolife and sugar levels in each group.

Mean	Group 1	Group 2	Group 3
Total Cholesterol	228.15±31.5	212.28±38.12	162.45± 25.44
Triglycerides	239.55±65.53	178.92±20.44	128.45±14.2
HDL	46.7±9.25	52.22±12.97	53.45±7.88
LDL	96.29±25.55	132.78±16.49	102.12±18.25
FBS	135.73±55.45	104.47±35.37	83.45±12.54
PPBS	218.8±85.88	179.75±20.29	124.52±12.25

In this study, the mean cholesterol is higher in both groups 1 and 2. Group1 observed as higher when compare to group 2. Levels of Triglycerides also observed as higher in group 1 than group 2. Total cholesterol levels value had statistical significance p = 0.012 (Table 2).

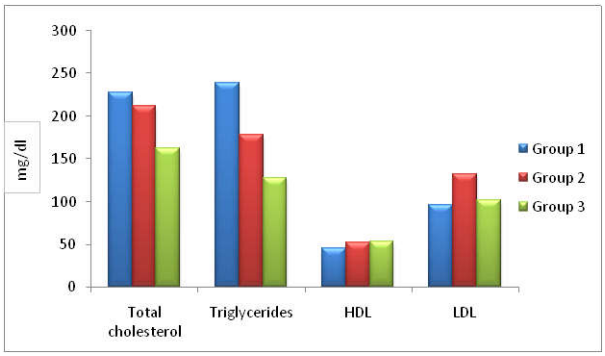

Fig. 1: Graph showing mean value of various lipid parameters in different groups

In this study, group 1 patients in all severity groups had increased total cholesterol levels and triglyceride levels. However, increased total cholesterol levels showing p value 0.016.

Total cholesterol levels observed as higher in patients with severe NPDR, very severe NPDR and PDR, when compare to subjects with diabetic retinopathy (p =0.046).

In this study, it is evident that most of the subjects in group 1 showing high blood sugar levels. Mean Fasting sugar levels and PPBS levels were higher in group1 when compared to group 2.

In lipid profile, diabetic retinopathy groups with and without CSME, observed to be cholesterol concentration was significantly higher in the retinopathy subjects with CSME when compared to without CSME (p=0.001).

Severity of diabetic retinopathy did not show a linear trend for the decreased visual acuity. As the patients were of geriatric age group, they had associated cataract causing visual impairment.

Discussion

Diabetes mellitus is the most common metabolic disorder in India.increasing prevalence of DM leads to macrovascular and microvascular complications. Diabetic retinopathy may leads to blindness. Persons with diabetes mellitus may have 20 to 25 times greater risk of blindness when compared to normal population. As the prevalence of diabetes is increasing, the incidence of diabetic retinopathy is also increasing [15]. Patients with diabetes mellitus commonly affected by dyslipidemia metabolic disorder. The role of dyslipidemia in diabetes mellitus for the development of microvascular complications is not fully understood [16]. Hence, our study designed to analyze the association between serum lipid profile and diabetic retinopathy severity.

In current study, 200 type II diabetes mellitus patients of ages ranging from 45-80 years as cases, also including 100 age and sex matched controls were analysed biochemically. The patients categorized according to with or without diabetic retinopathy and CSME.

In this study, the male to female ratio observed as 53:47. In a study, diabetic retinopathy incidence observed more in the males compared to females (sex ratio 2:1) [17] and also in the CURES Eye study [18], UKPDS study [19] Gupta et al. [20] and the Andhra Pradesh Eye Disease study (APEDS) [21]. The difference with respect to the sex distribution was not statistically significant in the current study (p =1).

The incidence of retinopathy and the Mean age of the patients in each group (61.45±6.99, 57.96±6.07 and 61.05±7.47 years) was correlating. Our study also showed an increased prevalence of DR with increasing age. APED Study 21, CURES Eye Study [18], Dondana et al., 3 demonstrated significant association between age and diabetic retinopathy prevelance.

In our study, the association of longer disease duration with higher risk of diabetic retinopathy (p=0.000), was also same as previously conducted studies like DCCT [22], WESDR/Klein et al. [23], UKPDS [19], Larsson et al. [24], Wong et al. [25], Varma [26], and Wisconsin Epidemiological Study of diabetic retinopathy [23]. Indian studies are also supporting the correlation [27], Gupta et al. [20]. APEDS study [21] Agarwal et al., [28]. According to CURES Eye study for every five year increase in duration of diabetes, the risk for diabetic retinopathy increased by 1.89 times [18.]

There is strong evidence that the long term glycemic control plays an important role in delaying the onset and the progression of DR [11]. In the current study, most of group 1 patients had poor glycemic control when compared to group 2. Strict glycemic control was effective in significantly reducing the incidence and progression of retinopathy complications in study of diabetes control and complication trial (DCCT) group [27]. The UKPDS study also showed that intensive glycemic control reduced the risk of two-step change in retinopathy by 21% in 12 years follow up [27,19]. In Wisconsin Epidemiological Study (WESDR) 28 and CURES eye study [18], they observed a linear trend between prevalence of diabetic retinopathy and poor glycemic control.

Current study observed statistical significant

correlation among the grades of diabetic retinopathy and total cholesterol level (p = 0.016). The mean total cholesterol and triglyceride levels were high in group 1 than group 2 and group 3. But this correlation does not shows statistically significant (p = 0.8).

According to Early Treatment Diabetic Retinopathy Study (ETDRS), patients with increased serum cholesterol levels or LDL levels at baseline were twice as likely to have diabetic retinopathy than patients with normal lipid profile [29].

Al-Bdour et al. [9] and Larsson et al. [24] observed positive correlation between diabetic retinopathy and hypercholesterolemia (p=0.04). These findings were also same with the present study.

Rema et al., studied correlation between serum lipids with diabetic retinopathy in urban south Indian population. Serum triglyceride (p= 0.001) levels and serum cholesterol levels (p= 0.014) observed high in patients with diabetic retinopathy [30], after adjusting for age. Similar results were seen in Haddad et al. [31]. In our present study, total cholesterol and TGL levels were high in group 1 as compared to group 2 and group 3, but only hypercholesterolemia shows statistically significant.

According to the Hoorn Study, incidence of diabetic retinopathy and hard exudates are related to elevated serum total and LDL cholesterol levels [27]. Agarwal et al. [28] and Sachdev et al. [33] also observed increased level of total and LDL cholesterol and reduced level of HDL/LDL cholesterol ratio in patients with diabetic retinopathy. These results are partly in correlation with our study as hypercholesterolemia but not hypertriglyceridemia was found to be a risk factor for retinopathy.

According to Klein et al., severity of diabetic retinopathy and retinal hard exudate are associated with cholesterol levels [23]. In our study, total cholesterol level is not related to the severity of DR.

Elevated triglyceride is an important risk factor for moderate and severe nonproliferative retinopathy and proliferative retinopathy even after adjustment for age, duration of diabetes, HbA1c, and proteinuria in EURODIAB study [34].

The present study shows significant correlation between hypercholesteremia and CSME, which was same with study by Al-Bdour et al. [9], and Wisconsin Epidemiological Study of Diabetic Retinopathy [23], and CURES Eye Study [18]. In a prospective analysis of ETDRS data, the development of CSME was 50% faster in patients with hypercholesterolemia and hypertriglyceridemia [29].

In our study, the severity of diabetic retinopathy not correlating with the increasing levels of serum lipid sub-fractions.

The current study did not show correlation between serum lipid levels and visual acuity as most of the cases had associated cataract. CURES eye study showed that visual acuity decreased with increase in severity of retinopathy18. As per the ETDRS study hypercholesterolemia increased the risk of visual loss by 50% [29].

The limitations of present study are that the fundus photographs and OCT were not taken.

Conclusion

The number of adults with diabetes in the world is estimated to increase by 122% (135 million in 1995 to 300% in 2025). This increase is expected to be 42% in the developed world and 170% in the developing countries. India stands first with 195% (18 million in 1995 to 54 million in 2025). The patients with retinopathy significantly shows longer mean duration of diabetes mellitus when compare to diabetics without retinopathy. The development and progression of diabetic retinopathy influenced by the level of hyperglycemia. In this study, group 1 patients (D.R) had increased total cholesterol levels and triglyceride levels. But, the severity of diabetic retinopathy not correlating with the increasing levels of serum lipid sub-fractions

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Original Article

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A Study in Dry Eye Among Patients with Pterygium at A Tertiary Care Centre, Narayana Medical College, Nellore

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Abstract

Aim: To find out the proportion of Dry eye among patients affected with Pterygium.

Materials And Methods: It was a cross-sectional study. The patients with clinical diagnosis of Pterygium were selected. Ocular examination with special emphasis on Schirmer test, Tear film Break–up Time, Tear Meniscus Height, size of Pterygium was conducted. Data was entered into Microsoft Excel. Statistical analysis was made using Chi-Square test and Correlation test.

Results: Dry eye condition was assessed on the basis of the tests. 20.5% of eye on Schirmer test, 33.5% of eyes on Tear film Break–up Time, and 59.5% of eyes on Tear Meniscus Height were found to be affected with Dry eye. Mean value of Schirmer test was 16.94 mm on right eye and 17.85 mm on left eye. Mean value of Tear film Break–up Time was 10.14 sec on right eye and 10.72 sec on left eye.Mean value of Tear Meniscus Height was 0.39 mm on right eye and 0.38 mm on left eye. The association between Dry eye tests and presence of Pterygium not showed any positive association, expect in the case of Tear film Break–up Time and Pterygium on right eye. The Dry eye tests between right and left eyes showed strong association, irrespective of unilateral or bilateral Pterygium.

Conclusion: Dry eye condition is seen at least in 26% of eyes, but significant association between Dry eye and presence of Pterygium is not seen. Irrespective of the eye affected with Pterygium, Dry eye tests of both eyes showed strong association. Further case control studies can be done.

Keywords: Pterygium; Dry Eye; Schirmer's Test; Tear Film Break–Up Time; Tear Meniscus Height.

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Introduction

Pterygium is a degenerative condition resulting in the formation of fibrovascular wing shaped tissue that develops from the conjunctiva & encroaches on to the cornea [1].

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Presently, it is believed that Pterygium most commonly affects the individuals who are exposed to the outdoor environment particularly in tropical and subtropical countries, therefore, exposure to dry, dusty, windy, and sunny weather is blamed to be the risk factor [2].

The pathogenesis of pterygium is still not completely understood. An overall view of the growth process reveals a multiplicity of factors that are correlated and interrelated. Recent evidence implicates anti-apoptotic mechanisms, immunological mechanisms, cytokines, growth factors, extracellular matrix modulators, genetic factors and viral infections, among other possible causative factors [3,4]. In addition; there are associations with rural regions, increasing age and male gender, which correlate with outdoor work [5]. Early pterygium is usually asymptomatic.

Pterygium causes dryness, burning and itching due to irregular wetting of the cornea. Apart from being a cosmetic blemish, it can cause significant visual impairment induced due to corneal astigmatism and also cause persistent ocular discomfort to the patients often requiring surgical intervention [6].

Conventional surgical procedures practiced nowadays to prevent recurrence, alone or in combination, are conjunctival flap, conjunctival rotational autograft, amniotic membrane graft (AMG), or free conjunctival autograft (CAG) or limbal CAG (LCAG) with surgical adjunct (e.g., suture, commercial fibrin glue, intra-or post-operative 0.02% mitomycin C [MMC]), with variable postoperative recurrence and/or success rates [7].

CAG surgery with the use of fibrin glue, sutures, or MMC was generally regarded as the procedure of choice where surgery is indicated for the treatment of primary and recurrent pterygium, primarily because of its comparable recurrence rate, efficacy, and longterm safety in contrast to other procedures [8,9]. However, using these surgical adjunct has surgical risks and complications too [10].

One of the theories is that the tear film abnormalities causes local drying of the cornea & conjunctiva which in turn predisposes to these new growths and exposes epithelium directly to the destructive effect of UV rays [11]. Whether tear dysfunction leads to Pterygium or Pterygium causes tear dysfunction is not clearly understood. The present study aims to assess Dry eye condition in patients with Pterygium.

Materials and Methods

A cross-sectional study was conducted among 100 patients with pterygium attending the Outpatient section at Department of Ophthalmology, Narayana Medical College and Hospital, Nellore. The study period was 18 Months (01st Jan 2017 to 01st July 2018). Inclusion Criteria are patients with clinical diagnosis of Pterygium and willing to participate in the study. Exclusion Criteria are patients with acute eye condition like watering, itching or pain are excluded and those who had eye surgery within the last one month or awaiting surgery in the next few days. Study Tools were pre-tested questionnaire, external eye examination under torch light, slit lamp examination and direct ophthalmoscopy, Schirmer's test without anesthesia, Tear film break-up time test, Marginal Tear film meniscus height.

Methodology

After obtaining informed consent, data was collected from each patient using a pre-tested questionnaire. Size of Pterygium, Schirmer's test,Tear film Break-up Time and Tear Meniscus Height were assessed. Tests were done for each eye.

1. Schirmer's Test I (Test without Anaesthesia): Whatman No. 41 filter paper folded at one end, kept inside the lower eye lid at the junction of medial 2/3rd and lateral 1/3rd. The patient was asked to keep the eyes open for 5 minutes. Gentle blinking was allowed if needed. At the end of 5 minutes, reading on the strip was taken. This data was then taken for analysis.

2. Tear film Break-up Time: Fluorescein strip was used to stain the tear film by keeping the chin on the slit lamp chin-rest. Patient was asked to blink a few times, then to keep the eyes open. The tear film over the cornea was examined under cobalt blue filter with broad beam of slit lamp. Time taken between the last blink and the appearance of first dry spot was taken in seconds.

3. Tear Meniscus Height: The height of the tear meniscus is taken by directing the slit lamp beam towards the lower lid margin and adjusting the size of graticule to match the meniscus height.

4. Size of the Pterygium from the limbus to apex was taken by keeping the beam of slit lamp in the horizontal axis.

5. Dry eye was considered to be present on the basis of the tests:

Schirmer's test without anaesthesia :

less than 10 mm

TBUT: less than 10 seconds

TMH: less than 0.50 mm

Ethical Clearance and Conflict of Interests

The study proposal was presented before the Institutional Ethical Comittee and was approved. All the guidelines of the committee was followed during the study period. There were no conflict of interests involved. There was no external funding sources.

Data Analysis

Collected data were coded and entered in Microsoft Excel 2010. The data has been analyzed using SPSS version 22.0. Chi-Square test was used to find association. p value of less than or equal to

0.05 was considered as statistically significant.

Results

Out of 100 patients with Pterygium on either one eye or both eyes, among which 36 were male and 64 were female patients (Table 1).

Size of Pterygium

The overall mean values of size of Pterygium were 1.89 mm for right eye with mean values of 1.0 mm for males and 2.20 mm for females. It was 1.24 mm left eyes with mean values of 1.11 mm for males and 1.30 mm for females.

Table 1: Age –wise comparision of mean values of size of Right and Left Pterygium

	Right Pterygium			Left Pterygium		
Age	Over all	Male	Female	Over all	Male	Female
< = 35	1.67	1.50	1.75	1.83	2.00	1.75
36 - 45	1.76	1.73	1.80	1.57	1.64	1.50
46 - 55	1.87	1.83	1.88	1.78	1.67	1.82
56 - 65	1.74	1.80	1.71	1.68	1.68	1.71
>= 66 years	1.68	1.71	1.67	1.84	1.71	1.92

Table 2: Mean values of Dry eye tests of study population

	Dry Eye Examination : Mean Value					
Gender	**RSCHIRMR**	**LSCHIRMR**	**RTBUT**	**LTBUT**	**RTMH**	**LTMH**
Overall	16.94	17.85	10.14	10.72	0.39	0.38
Males	15.88	17.77	9.94	11.41	0.4	.39
Female	17.53	17.89	10.2	10.3	0.38	0.38
			Age (Overall)			
< = 35	22.0	21.80	13.33	14.16	0.48	0.15
36 - 45	18.47	18.09	10.0	11.09	0.40	0.17
46 - 55	21.30	20.60	10.80	10.13	0.43	0.21
56 - 65	13.90	16.20	9.0	9.45	0.34	0.20
>= 66 years	13.20	15.60	10.20	12.0	0.36	0.19
			Age and Gender (Male)			
< = 35	14.50	14.50	15.0	15.0	0.35	0.35
36 - 45	19.10	19.81	9.81	11.60	0.47	0.44
46 - 55	19.50	19.66	10.80	9.60	0.46	0.33
56 - 65	13.20	16.70	10.0	11.70	0.32	0.37
>= 66 years	11.90	15.40	7.8	11.10	0.37	0.41
			Age and Gender (Female)			
< = 35	25.70	25.50	12.50	13.75	0.55	0.42
36 - 45	17.70	16.20	10.20	10.50	0.33	0.36
46 - 55	21.20	20.90	10.80	10.29	0.42	0.42
56 - 65	14.20	15.90	8.50	8.38	0.35	0.39
>= 66 years	14.0	15.80	11.6	12.50	0.36	0.31

Table 2 shows that Mean value of Schirmer test of right and left eye in the present study is 16.94mm and 17.85mm respectively. Mean value of TBUT of right and left eye in the present study is 10.14 sec and 10.72 sec respectively. Mean value of TMH of right and left eye in the present study is 0.39mm and 0.38mm respectively.

Statistically significant association was not found between the presence of Pterygium and the dry eye. Also, there was no association between size of Pterygium and dry eye.

Table 3: Pearson's correlation between pterygium and dry eye tests

Correlation Between Pterygium And Dry Eye		
Correlation Between	**Correlation Coefficient**	**Remarks**
RSCHIRMR – RPTRGY	0.313	Very weak positive correlation
RTBUT-RTPRGY	0.191	Very weak positive correlation
RTMH-RPTRGY	0.035	Negligible correlation
LSCHIRMR-LPTRGY	-0.137	Very weak negative correlation

LTBUT-LPTRGY	0.020	Negligible correlation
LTMH-LPTRGY	-0.105	Very weak negative correlation
RSCHIRMR-LSCHIRMR	0.636	Strong positive correlation
RTBUT-LTBUT	0.621	Strong positive correlation
RTMH-LTMH	0.619	Strong positive correlation
RPTRGY-LPTRGY	0.76	Negligible correlation

Table 3 shows that the present study found weak or negligible correlation between dry eye and size of Pterygium.

Dry eye examination - Pterygium (Right eye)

Table 4: Relation between right SCHIRMER test, TBUT, TMH with right eye pterygium.

	RPTRGY		
RSCHIRMER	No Pterygium	Pterygium Present	Total
yes (<10)	8	15	23
no (>=10)	16	61	77
$\chi2$ = 1.904 df=1 p= 0.16			
RTBUT	No Pterygium	Pterygium Present	Total
yes (<10)	4	32	36
no (>=10)	20	44	64
$\chi2$=5.123 df=1 p=0.024			
RTMH	No Pterygium	Pterygium Present	Total
yes < 0.5	13	46	59
no (>= 0.5)	11	30	41
Total	24	76	100
$\chi2$=0.305 df=1 p=0.638			

Table 4 shows that there was no association between right SCHIRMER test and right eye TMH with right eye Pterygium,but there was an association between right eye TBUT and right eye Pterygium.

RPTRGY: Pterygium on Right eye,

LPTRGY: Pterygium on Left eye,

RSCHIRMR: Schirmer test on right eye (without anaesthesia)

LSCHIRMR: Schirmer test on left eye (without anaesthesia),

RTBUT: Tear film break –up time test on right eye,

LTBUT: Tear film break -up time test on left eye,

RTMH: Tear meniscus height on right eye

LTMH : Tear meniscus height on left eye

Dry eye examination: pterygium (Left eye)

Table 5: Relation between left SCHIRMER test, TBUT, TMH with left eye pterygium.

	LPTRGY		
LSCHIRMER	No Pterygium	Pterygium Present	Total
yes (10)	4	19	23
no (>=10)	24	53	77
$\chi2$=1.668 df=1 p=0.197			
LTBUT	No Pterygium	Pterygium Present	Total
yes (<10)	13	23	36
no (>=10)	15	49	64
$\chi2$=1.836 df=1 p=0.175			
LTMH	No Pterygium	Pterygium Present	Total
yes < 0.5	19	40	59
no (>= 0.5)	9	32	41
Total	28	72	100
$\chi2$=1.261 df=1 p=0.261			

Table 5 shows that there was no association between left Schirmer test, left eye TBUT and left eye TMH with left eye pterygium.

RPTRGY: Pterygium on Right eye,

LPTRGY: Pterygium on Left eye,

RSCHIRMR: Schirmer test on right eye (without anaesthesia)

LSCHIRMR: Schirmer test on left eye (without anaesthesia),

RTBUT: Tear film break –up time test on right eye,

LTBUT: Tear film break -up time test on left eye,

RTMH: Tear meniscus height on right eye

LTMH : Tear meniscus height on left eye

Discussion

Proportion of dry eye condition on the patients with Pterygium :

Based on Schirmer Test

Twenty three percent (23%) of right eyes with Pterygium showed dry eye condition. 18% of left eyes with Pterygium are affected with dry eye condition. On average, dry eye condition is seen in 20.5% of eyes with Pterygium in the present study. Different studies show a wide range from 8.00% to 52.00%. Studies such as Goldberg, Roka N, Ranjana, Atiya, Balogun [12-16] shows 52.54%, 31.57%, 8.00%, 9.30%, 31.20% respectively.

Based on TBUT

Dry eye is seen in 36% of right eyes with Pterygium and 31% of left eyes with Pterygium. On average, dry eye is seen in 33.5% of eyes with Pterygium in the present study. Different studies show range from 30.00% to 75.00%. Studies such as Goldberg, Roka N, Ranjana, Atiya, Balogun, Amer Y [12-17] shows 50.84%, 43.42%, 30.00%, 75.60%, 39.70%, 47.20% respectively.

Based on TMH

Fifty nine percent (59%) of right eyes with Pterygium and 60% of left eyes with Pterygium have dry eye. On average, present study and Muhammad Saleem [18] shows 59.50% and 37.50% dry eye respectively.

Comparative Studies

Mean value of Schirmer test of right and left eye in the present study is 16.94mm and 17.85mm respectively. Studies such as Muhammad Saleem [18], Rajiv et al. [19], RokaN [13], Kampitak [20], Chaidaraoon [21] has mean value of 5.2mm, 5.2mm, 16.19mm, 9.8mm, 11.6mm respectively. Mean value of TBUT of right and left eye in the present study is 10.14 sec and 10.72 sec respectively. Studies such as Rajiv et al. [19], Muhammad Saleem [18], Roka N [13], Kampitak [20], Amer Y [17], Balogun [16], Ann Tresa Antony et al. [22], Manhas A et al. [23], Rajab AY [24], El-Sersy TH [25] has mean value of 5.6 sec, 6 sec, 10.56 sec, 5.5 sec, 11.1 sec, 17.9 sec, 7.6 sec, 9.88 sec, 11.4 sec, 5.91 sec respectively. Mean value of TMH of right and left eye in the present study is 0.39mm and 0.38mm respectively (No studies to compare).

Range of Dry Eye Tests

Range of Schirmer test of the present study and other studies such as Rajiv [19], Muhammad Saleem [18], Roka N [13] was 1 to 35 mm, 3 to 9.4 mm, 3 to 14 mm, 2.50 to 35 mm respectively. Range of TBUT of the present study and other studies such as Muhammad Saleem [18], Roka N [13] was 3 to 25 sec, 3 to 14 sec and 2.5 to 27.50 sec respectively. Range of TMH of the present study is 0.2 to 1.00 mm (No comparitive studies).

Kampitak et al. [20] found that mean horizontal size of Pterygium ± standard deviation was 2.1 ±0.7mm. The mean±standard deviation of TBUT in Pterygium eyes was 5.5±1.9 seconds. In the contralateral normal eyes it was 11.3±2.7 seconds ($p<0.001$). The Schirmer test results in Pterygium eyes and the opposite normal eyes was not statistically significant. Both TBUT and Schirmer test results had no correlation with Pterygium size.

Association between Dry eye and Presence of Pterygium

The present study showed no association between dry eye and the presence of Pterygium, except in right eye Pterygium with TBUT. The lack of association between dry eye and Pterygium is similar to the observation by Goldberg et al. [12], Balogun [16], Jie et al. [26]. The result is in contrast with six other studies which showed a positive correlation between dry eye and Pterygium [27,19,13,16,21,28]. Decreased TBUT, but normal Schirmer test was found by Kampitak et al. [20]. The present study also showed similar results in the case of the right eye.

Correlation Between Dry Eye and Size of Pterygium

The present study found weak or negligible correlation between dry eye and size of Pterygium. This agrees with the observation by Kampitak et al [20].

Conclusion

On the basis of different criteria at least 26% of eyes with Pterygium (either unilateral or bilateral) are affected with dry eye. The tests showed different proportions of dry eye condition among the patients with Pterygium:

Schirmer test: 20.5%

TBUT: 33.5%

TMH: 59.5%

Declaration of Patient Consent

The authors certify that they have obtained all appropriate patient consent forms. 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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Conflicts of interest:

There are no conflicts of interest.

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Original Article

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A Clinical Study of Etiology and Pathogenisis of Chronic Dacryocystitis in A Tertiary Care Centre

R. Sudha

Abstract

Background: Dacryocystitis is infection of the lacrimal sac. It results from stasis of lacrimal secretions due to blockage of the nasolacrimal duct. The present study was done to determine the common casuative bacteria and histopathological examination of lacrimal sac in chronic dacryocystitis.

Methods: About 50 patients of chronic dacryocystitis are selected. Samples from the contents of the lacrimal sac are collected from these patients and sent to microbiology department for culture for aerobic and anaerobic bacteria and fungi .Samples were collected from 13 patients who underwent dacryocystectomy.

Results: Fifty patients with an average age of 52.5 years (range, 6mths –70 years) of chronic dacryocystitis were identified. Female subjects (68%) predominated in the present study. As per the cultures from the nasolacrimal sac about 42 (84%) were positive for bacteria, mostly gram positive bacteria predominated by pneumococcus (40%). Non-granulomatous inflammation of the sac is observed in histo pathological reports of all the 13 specimens.

Conclusions: Gram positive bacteria mainly pneumococci was the commonest pathogen isolated. In lacrimal sac biopsy, non-granulomatous inflammation consistent with chronic dacryocystitis is the most common finding.

Keywords: Dacryocystitis; Gram Positive Bacteria; Lacrimal Sac.

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Introduction

Dacryocystitis is one of the most prevalent ocular disease. Dacryocystitis has a worldwide distribution having a higher incidence among the people living in tropical countries. Commonly seen in people with poor hygienic conditions. It can be congenital or acquired. Most commonly seen in females probably because of narrow nasolacrimal duct and anatomical changes in the bony canal. The etiology of chronic dacryocystitis is complex and has many causes. It may be inflammatory or non inflammatory. Anatomical factors retarding the drainage of tears like neoplasms, foreign bodies, Dacryoliths, nasal polyps, deviated nasal septum, hypertrophied inferior turbinate etc. contribute to stasis and infection. It can be infective (Bacterial, viral and fungal), non infective (Atonic), it can be acute or chronic form [1].

Chronic dacryocystitis is more commonly seen than the acute form. The source of infection is either from conjunctival sac or nasal cavity. Bacteria like as Staphylococcus epidermidis, Staphylococcus aureus, Pneumococcus, Pseudomonas, E.coli, etc are the most common causative agents. Other rare causes of chronic dacryocystitis are granulomatous inflammation due to tuberculosis, syphilis, and fungi like Candida and Aspergillus.

Apart from its discomfort and social inconvenience, its perpetuation leads to a vicious circle of stasis and infection causing chronic irritative conjunctivitis and eczematous conditions of the skin of the lids.

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Among the acute and chronic forms, the latter being the most prevalent, amongst the general population. Acute exacerbation of chronic dacryocystitis leads to lacrimal abscess which eventually may rupture and heal spontaneously or form a lacrimal fistula.

An infected lacrimal sac (Chronic) is a constant source of infection and minor corneal abrasions may lead to corneal ulceration, if not treated timely may result in panophthalmitis, Hence any case of non healing corneal ulcer should always be tested for NLD patency and if found to be obstructed, Dacryocystectomy should be performed. Some other complications are intractable conjunctivitis, scleral abscess, facial cellulitis, orbital cellulitis, increased incidence of post operative endophthalmitis , and cavernous sinus thrombosis.

Umesh Bareja and Ghose isolated gram positive cocci with streptococcus pneumoniae predominating the cultures [4].

Purgason PA, Hornblass A, Loeffler M conducted a study which showed two cases of candida albicans as primary etiologic agent of dacryocystitis [5].

Surgery for sinus, nasal polyps, fractures of nose may act as a precipitating factor. Mauriello JA Jr., Fiore PM, Kotch M, described 66 year old women developing dacryocystitis unresponsive to medical management after 15 years of orbital floor fracture repaired with a silicone implant. Orbital computed tomography scan showed the silicon implant blocking the nasolacrimal sac and confirmed by probe test. Silicon implant is removed and dacryocystorhinostomy was done in that case of dacrocystitis [6].

Mauriallo et. al. reported inflammation or fibrosis but no tumors in histopathologic examination of 44 patients undergoing dacryo cystorhinostomy [7].

Karesh JW, Perman KI, Rodrigues MM highlighted the important role of lacrimal sac biopsy in the absence of obvious tumorous involvement by reporting four patients who presented with a dacryocystitis secondary to lacrimal sac l ymphoma [8].

To define the spectrum and relative incidence of the microorganisms causing chronic dacryocystitis.

To study histopathological picture of lacrimal sac in patients undergoing dacryocystectomy.

Methodology

The present study consists of 50 cases of chronic dacryocystitis including all age groups and of both the genders, selected from the patients attending the OPD in the Department of ophthalmology during the year Feb 2016 to Nov 2017.

The present study was conducted upon the patients of all age groups, different occupations and socioeconomic status. Detailed clinical history was taken and proper evaluation was done. Lacrimal sac syringing was done and swabs were taken from the regurgitation samples without touching the skin, eyelids and conjunctiva and sent for culture to the microbiology department. Primary cultures require 24 hours to 48 hours.

Patients who underwent DCR were excluded as histopathological study could not be conducted in them.

Lacrimal Syringing was done as per the standard procedure. Regurgitated material from the lacrimal sac was collected first by applying pressure at the lacrimal sac region and if nothing was coming out then lacrimal syringing was done.

Microbiological Examination

It included Grams staining required to identify bacteria and their morphology which may show gram positive, negative cocci or bacilli, Zeil neelsen's Staining for mycobacterium. Bacterial culture was done for the identification of the exact causative organism whether aerobic or anaerobic organism in pure or mixed forms.

Ten percent (10%) Potassium Hydroxide smear was done to detect fungi like streptothrix and leptothrix. Culture in Sabouraud's Medium was done to identify fungal growth if any.

Histopathological Study

Histopathological examination of the lacrimal sac was done in patients who underwent dacryocystectomy. The lacrimal sac was examined histologically for chronic inflammation, any neoplasms, dacryoliths.

Results

A total of 50 cases were studied of which 16 (32%) were males and 34 (68%) were females. The incidence of chronic dacryocystits is more among females 68% as compared to males 32%.

According to the present study, chronic dacryocystitis is more common among people in the age group of 50–59 yrs (32%). followed by the age group 60–69 yrs and 30–39 yrs (24% and 14%), Next

commonest age group is 40–49 yrs (12%) followed by 0–9 yrs (6%) and 70 and above (6%) and 20–29 yrs (4%). Least common age group was 10–19 yrs (2%). The youngest among the case studied was 6 months old and the oldest being 70 years.

Table 1: Age group distribution

Sl.No.	Age group (yrs)	No. of Cases	Percentage
1	0 – 9	3	6
2	10 – 19	1	2
3	20 – 29	2	4
4	30 – 39	7	14
5	40 – 49	6	12
6	50 – 59	16	32
7	60 – 69	12	24
8	70 and above	3	6
	Total	50	

Chronic dacryocystitis has highest incidence in both males (12%) and females (20%) in 50–59 years age group. Next common incidence in 60–69 yrs (16%) females show similar incidence at 30–39, 40–49 years age (10%) followed by 10–19, 70 and above (4%). Least common age groups are 10–19 and 20 –29 years (2% each).

Next common age group in males is 60–69 years (8%) followed by 30–39 years (4%). Common incidence of 2% is noted among 0–9, 40–49 and 70 and above age group. 10–19 years show no incidence of disease in one study.

Among the total number of 50 cases the left side affected was 24 (48%) and that of right side 14 (28%) bilateral 12 (24%) cases. According to the study left side is more commonly affected than the right side. The incidence of the disease in left side in female population was 19/34 cases, as against 9/34 cases having right side affection. The proportion of females having left side affected was 4 times that of males having left side affected. Where as the right side affection is 3 times and bilateral affection is equal in both the genders.

According to this study females mainly housewives (42%) are affected most commonly. Followed by Labourers (18%) and agriculturists (12%)

Incidence of chronic dacryocystitis is less common in preschool children, professionals, teachers and students. People belonging to low socio economic group are commonly affected by chronic dacryocystitis. It is less prevalent in urban population. Coming to the presenting features epiphora is more common. According to the present study 50% of cases presented with only epiphora and 40% of cases with epiphora and discharge (mucous or mucopurulent or purulent).

Thirty four percent (34%) of patients presented with diminution of vision, due to cataract and were incidentally found having chronic dacryocystitis when investigating for cataract surgery. Epiphora associated with redness and swelling is evident in few patients (14%). Conjunctivitis with matting of lashes and oedema of lids were complained by 6% of patients. Corneal ulcer is seen in only one patient with chronic dacryocystitis.

As per the present study 80% of cases presented as Chronic dacryocystitis per se. About 12% of patients had associated mucocele. Third most clinical presentation was Congenital dacryocystitis, 6% in one study. Lacrimal abscess is the least common variety.

In the present study of 50 cases , 17 cases had ENT problems. Most common among them was DNS contributing to (58.8%) followed by hypertrophied inferior turbinate in about 5 cases (29.4%). One case each of maxillary sinusitis and nasal polyp were associated with chronic dacryocystitis.

Majority of the cases (70%) are associated with cataract. 25% of cases had chronic conjunctivitis either may be the cause or sequelae of chronic dacryocystitis. Corneal ulcer was seen in only one patient (4.16%). Diabetes mellitus was associated with 60% of cases and 40% of the patients were hypertensives. Chronic dacryocystitis was not due to systemic diseases.

Pneumococci is the most common causative organism contributing to 40% of samples studied, followed by staphylococcus (16%), Klebsiella (12%), Pseudomonas, E. coli, Diphtheroids (4%) each, Non-fermenting gram negative bacilli, Beta-hemolytic streptococci (2% each) in a descending order. Out of 50 samples 8 samples were sterile.

Table 2: Microorganisms distribution

Sl. No.	Organisms	No. of Cases	Percentage
1	Pneumococci	20	40
2	Klebsiella	6	12
3	E. Coli	2	4
4	Staphylococcus	8	16
5	Non-fermenting Gram negative bacilli	1	2
6	Pseudomonas	2	4
7	Beta hemolytic streptococci	1	2
8	Diptheroids	2	4
9	Sterile	8	16
	Total	50	

Macroscopic Appearance

Out of the 13 patients operated for chronic dacryocystitis by dacryocystectomy, 10 patients showed enlarged sac with thick wall and soft feel which were included in type I appearance and type II appearance showed shriveled up, atrophic sac with thin wall constituted 3 cases .

Microscopic Appearance

In the present study of 13 cases, chronic catarrhal type constituted 46.15% (6 cases), fibrotic type 23.07% (3 cases), follicular type 15.38% (2 cases), one case each of non- specific and hyper plastic type 7.69%. Chronic catarrhal type was the most common variety found and the next common in sequence were fibrotic, follicular, hyperplastic and non specific type.

Discussion

Chronic dacryocystitis is multifactorial. The pattern of incidence, age group affected, etiology of the disease varies in different studies.

According to the present study 6th decade (32%) was the most common age group affected which correlated well with the results of the study conducted by Chaudhry I A21, and by Jauko Hartikainen [3].

In the present study incidenceof chronic dacryocystitis was found to be more common in females (68%) which correlated well with chaudhry IA, and Jouko Hartikainen, Duke – Elder [10].

Coming to laterality, Left side (48%) is relatively more affected than right side (28%). This correlated well with P. Shiva Reddy 22 studies. In general the disease has prediliction to left side especially in females because of narrow bony canal.

Chronic dacryocystitis is more common among females. 21 Majority of the females are housewives (42%). Most of them belong to low socioeconomic status.

The rate of infection is more common among males who belong to agricultural labourer group (18%) because of occupational exposure and poor hygienic conditions.

Epiphora is the main presenting feature (50%) followed by epiphora with discharge (40%). This correlated with the results of Jouko Hutikainen. (76%) [3] and P. Shiva Reddy (80%) [22]

Few patients had epiphora with mucocele (14%) in our study ,which correlated with P. Shiva Reddy (25%) [22] study. Redness and stickiness of lids constituted (14%) of cases in our study and more incidence was seen in Prof. P. Shiva Reddy studies [22] (75%).

In the present study Chronic dacryocystitis without associated mucocoele or lacrimal abscess was the most frequently encountered clinical type (80%) on par with the results of Sood. N.N [23] (66%). The next common presentation was mucocele (12%). The incidence of Congenital dacryocystitis and lacrimal abscess was (6%, 2%) respectively.

Cataract was the most commonly associated ocular condition (70%) and were found having chronic dacryocystitis during pre operative checkup, followed by chronic conjunctivitis (25%) followed by corneal ulcer (4.16%).

According to the present study conducted (34%) of cases had nasal and paranasal pathology which is comparable to Rajeev N. Bhale [24] study showing (29%). DNS was the common nasal pathology observed constituting (58.8%) of total cases followed by hypertrophied inferior turbinate (29.4%).

In our present study, diabetis mellitus was the most common associated systemic condition (60%) followed by hypertension (40%).

Microbiological Study

In our present study Pneumococcus was the most common causative organism (40%). Blockage of NLD by common nasal commensals reslting in improper drainage of lacrimal secrtions and stasis followed by secondary infection contribute to chronic dacryocystitis. These organisms are seen in the regurgitant material. Since, pneumococcus is the most common naso pharyngeal commensal, it's the most common organism isolated in the cultures. Our present study correlated fairly well with Umesh Bareja 4 (28.9%), but poorly with Coden et al. 25 (2.3%) study, which has shown staphylococcus species as commonest organism cultured (64.5%).

Staphylococcal (16%) was the second commonest organism isolated in the present study which correlated with Jouko Hartikainen [3], Coden et al. [25], Umesh Bareja [4] their percentages being (47%, 27.3%, 13.2%) respectively.

Klebsiella species was the next commonest organism isolated (12%), which is in correlation with other studies of Rajeev N Bhale (1.63%) [24], Jouko Hartikainen (1.3%) [3].

Pseudomonas aeruginosa constituted 4% which correlated with Jouko Hartikainen [3] (9%) study.

In the present study 16% cases were sterile,which can be compared to Jouko Hartikainen [3] (15.7%), Umesh Bareja [4] (82.5%) studies.

In the present study no fungal isolates were seen.

Histopathological Study

The histopathological examination of the excised lacrimal sac showed non granulomatous type of dacryocystitis.

Non granulomatous inflammation consistent with dacryocystitis is the most common diagnosis in our study (100%) which correlated well with Anderson NG [26] study (85.1%) and Maureillo JA Jr [27] study (89%).

The limitation of the present study was investigations like dacryocystography and dacryoscintigraphy were not done.

Conclusion

Chronic dacryocystitis is the most commonly seen ocular adnexal disease.

Chronic dacryocystitis shows highest incidence in sixth decade of life, more common in females than in males, more common among people of poor socio economic group. No organisms were isolated from congenital dacryocystitis cases studied. Epiphora was the most common presenting feature.

Most of the cases (70%) were diagnosed of having chronic dacryocystitis incidentally while investigating a case of cataract. DNS was the predominant nasal association. Majority of patients had associated diabetes mellitus.

Most common organism isolated was pneumococcus. Non-granulomatous inflammation was the most common type of inflammation in histopathological study.

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The Glaucoma, Maculopathy and Cataract Surgery in Rural Area of Chhattisgarh, India

Divya Verma[1], Jainedra Rahud[2]

Abstract

Aim: The main objective of the current study is toinvestigate that the prevalence of maculopathy in rural area of Chhattisgarh. *Material and methods:* A retrospective study was conducted inthe department of ophthalmology at Lakhiram Agrawal Memorial Govt. Medical College and associated Kirodimal Govt. Hospital, Raigarh, (CG), total 415 patients were screening in the aged group of 40 years to above. Essential ophthalmic examination was done before the oparation. *Result:* Out of 415 patients, fifty-four (10.52%) were diagnosed tomaculopathy suspect. out of 54 (27) patients were POAG, 18 (3.5%) had PACG, 5 (0.97%) had lens induced glaucoma and 4 (0.77%) wereglaucomasuspected. *Conclusion :* Finding of the current study concluded that the Performing of a comprehensive eye evaluation for cataract surgery was great importance in the detection of undiagnosed maculopathy (retinal disease blindness). It is the most important causes of the rural area of Chhattisgarh in central India population.

Keywords: Glaucoma; Maculopathy; Cataract Surgery; Prevalence.

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Introduction

The term glaucoma,maculopathy and cataract surgery is a group of progressive optic neuropathies; it is characterizedby the degeneration of retinal ganglion cells and resulting from the changes in the optic nerve head. It causedby the loss of ganglion cells, therefore related to the level of intraocular pressure [1]. The Cataract, maculopathy and glaucoma are frequently coexisting ocular conditions in the elderly group of population worldwide; cataract, maculopathy and glaucoma are a natural part of the aging process [2]. People over 60 years of age have affected more common with glaucoma, this is the more common and serious sight-threatening conditions. Glaucoma and maculopathy is responsible for significant ocular morbidity in India [3]. Primarily glaucoma was accountedfor the 2/3rds of the morbidity in India and worldwide [4]. Currently there is a significant lacuna of studies about cataract and glaucoma in this region of India. Our study is a step toward it with the aim to find out the prevalence of maculopathy, glaucoma in the patients with cataract who were referred to thehigher study center and institutions.

Research design-the current study was done by the retrospective research design.

Methods

Sample and Procedure

For the purpose of our study we used screening techniques and scientific method for sample selection, total 415 participants were involved in the present study, 54 out of 415 patients which were affected with the disease of glaucoma and maculopathy.

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The retrospective study was conducted in the department of ophthalmology, at Lakhiram Agrawal Memorial Govt. Medical College and associatedKirodimal Govt. Hospital, Raigarh, Chhattisgarh, India. All the 415 consecutive patients werereferred for cataract surgery in the month of September to November 2016, before the cataract surgery some screening techniques were done.

Procedure of Sampling and Screening for Cataract Surgery

The detailed history and demographical profile were taken using self-made questionnaire, slit lamp examinations were done, ocular co-morbidity, intraocular pressures, fundus examination, gonioscopy, 90D examination, and visual fields were done by the appropriate apparatus. The External examination and pupillary evaluation were done in the normal flashlight. The Slit lamp bio-microscopy was doneto rule out any abnormalities of the anterior segment. The anterior chamber depth was graded according to the Van Herick's technique. Intraocular pressure (IOP) was recorded with the Goldmannapplanation tonometer under the topical anesthesia. Gonioscopy was performed to examine the irideocorneal angle. The Goldman three mirror lenses were used and the angle was graded according to the Shaffer system. The degree of trabecular meshwork pigmentation and other angle abnormalities were recorded. Stereoscopic evaluation of the optic nerve head was performed using a 90 diopter (D) lens at the slit lamp. The vertical and horizontal cup-disc ratios (CDRs) were measured and recorded with the notching, splinter haemorrhages, and peripapillary atrophy.

Statistical Analyses

Purpose of the current study, the data was analyzed by descriptive analyses technique with the help of the SPSS 22 version.

Results

Finding of the result in the present study shows in the different tables. Total 415 subjects were examined (170 men 40.96%, 245 women 59.04%) of which 54 (13.01%) patients were suspected of maculopathy, 5.26% have OAG, 3.50% have ACG, 0.78% are glaucoma and maculopathy suspect and 0.98% have Lens induced glaucoma.

Table 1: Shows the age and sex distribution in thepatients

Variables		N	n%
Age (years)	40-50	43	10.36
	50-60	152	36.62
	>60	220	53.01
Sex	Male	170	40.96
	Female	245	59.04

Table 2: shows the Glaucoma and maculopathy suspect and Gonioscopy findings in the pateints

Variables		N	n%	Mean
Glaucoma and maculopathy Suspect	No	361	86.98	
	Yes	54	13.02	
	OAG		5.26	
	ACG		3.50	
	Lens-induced glaucoma		0.98	
Gonioscopy	Performed	52		
	Not Performed	2		
	IOP (mmHg)			20.1
	VCDR			0.4-0.6

Table 1 and table 2 shows that the males were more commonly involved among OAG and females were more among angle closure disease. Majority of patients with maculopathy were found to be >60yr of age. The mean IOP by Goldman applanation tonometer was 20.1 mmHg. Gonioscopy performed in both eyes of 52 maculopathy suspect subjects. Gonioscopy could not be done in 2 subjects because of corneal opacities. The mean Vertical cup-disc ratio (VCDR) was 0.4-0.6. Majority of cases with OAG was found to be in an early glaucomatous stage while ACG was found in moderately advanced glaucoma stage, which suggests that ocular morbidity and early progression is more common with angle closure disease.

Primary Open Angle Glaucoma

Table 3 reveal that there were 27 (5.26%) subjects (12 women, 16 men). The mean age was > 60 years. The mean IOP value was 21.2 mm Hg. Mean VCDR 0.4-0.6, fundus could not be seen in 3 subjects because of dense cataract and corneal opacity. Humphrey visual fields 30-2 were done in 20 subjects and advised after cataract surgery in rest. Out of 20 subjects, 14 were atearly glaucomatous stage, 4 were moderately advanced glaucoma, 1 severe glaucoma and 1 patient withend-stage glaucoma. Pseudo exfoliation was noted in 2 subjects.

Table 3: shows the sex distribution and examination finding of the Primary Open-Angle Glaucoma in the patients

Variables		N	n%	Mean
Primary Open Angle Glaucoma		27	5.26	
Age				64 years
Sex	Male	15	55.5	
	Female	12	44.5	
	IOP (mmHg)			21.2
	VCDR			0.4-0.6
Staging of Glaucoma (n=20)	early glaucomatous stage	14	70	
	Moderately advanced glaucoma	4	20	
	severe glaucoma	1	5	
	end-stage glaucoma	1	5	

Primary Angle-Closure Glaucoma

Table 4 shows that the primary angle-closure glaucomawas found in 18 subjects (3.50%) (10 women, 8 men); the mean age was between 40 to 50 years. The mean IOP value was 22 mm Hg. The mean VCDR was 0.5-0.6. The fundus could not be seen in 4 subjects because of dense cataract in 3 subjects and 1 has corneal opacity. On gonioscopy, out of 17 patient 3 patients had PAS present. Out of 14 patients, 3 were atearly glaucomatous stage, 10 were moderately advanced glaucoma and 1 patient withend-stage glaucoma.

Table 4: shows the sex distribution and findings of the primary Angle-Closure Glaucoma

Variables		N	n%	Mean
Primary Angle-Closure Glaucoma		18	3.50	
Age				46 years
Sex	Male	8		
	Female	10		
	IOP (mmHg)			22
	VCDR			0.5-0.6
Staging of Glaucoma (n=14)	early glaucomatous stage	3	21.4	
	Moderately advanced glaucoma	10	71.4	
	severe glaucoma	0	0	
	end-stage glaucoma	1	7.1	

Glaucoma Suspects

Table 5 reveals thatthere were 4 persons have glaucoma suspect (1woman, 3 men). Out ofwhich 2 subjects had ocular hypertension, 1 was diagnosed as PACS, and 1 had suspicious discs but no field changes.

Table 5: shows the sex distribution and findings of the Glaucoma suspects

Variables		N	n%
Glaucoma Suspects		4	
Sex	Male	3	75
	Female	1	25
	ocular hypertension	2	50
	PACS	1	25
	suspicious discs	1	25

Lens-induced Glaucoma

Table 6 reveals that5 patients showing the lens induced glaucoma.Fourpatients with phacomorphic glaucoma presented with very high IOP (unrecordably high) were advised urgent cataract surgery after control of IOP. One patient with phacolytic glaucoma presented with IOP 39mm Hg has also advised cataract surgery after controlling IOP.

Table 6: shows the IOP examination findings in the Lens-induced Glaucoma

Variables		N	n%	Mean
Lens-induced Glaucoma		5		
IOP (mmHg)	phacomorphic glaucoma	4	80	Unrecordably high
	photolytic glaucoma	1	20	39

Discussion

Purpose of the present study we have search the various studies done in thisfield and various research agencies reports, some reports and findings were supported our current work. The WHO report estimated that the 47.8% of global blindness is due to the glaucoma, the cataract burden was significantly high in the South Asia region with includes the India, 51% of blindness is due to the cataract [5]. The cataractsurgery is a major causes of avoidable blindness in the developing countries [6]. Cataractsurgery and glaucoma are frequently coexisting ocular conditions in the elderly age population worldwide. Our study finding are similar to the Chennai glaucomastudy, it reported that the glaucoma was detected in 20% of aphakic and 4.3% of pseudophakic eyes in urban population [7]. Other similar studieshave found that the age-specific prevalence for the eight population groupswas derived by regional models separately for OAG and ACG. Similar findings were obtained fromstudies conducted in different region

and countries of the world i.e. Europe OAG [8,9] Europe ACG, [10,11] Africa OAG, [12,13,14] Africa ACG, India OAG, [15,16,17] India ACG, [18,19,20] China and South East Asia OAG, [12,18,19] China and South East Asia ACG, [12,18,19] Japan OAG, [21,22,23] Japan ACG, [24] Latin America OAG, [25,26] Latin America ACG (Europe estimate used), and Middle East/North Africa OAG and ACG. The Glaucoma blindness was estimated by the Foster et al (2002) and they found that 10% of those with OAG and 25% of those with ACG were assumed to be bilaterally blind in the world wide [27].

Other studies have estimated that the numbers of glaucoma in worldwideby 2020, 60 million people will have OAG and ACG, and glaucoma will be the second leading causes of the world blindness, These estimates could be done by the surveys of different research in different regions such as North Africa and the Middle East Africa, OAG was estimated that the 2.22 million people wereaffected with glaucoma in the United States in 2002 [28]. another studies have predicted that 9.4 million Chinese people had OAG and ACG in 2001 [29]. Another studies predicted for the years 2010 that 9.2 million will have either OAG or ACG in China [30]. Another study, based on the major population were suggested that the12% of world blindness (4.4 million people) is caused by glaucoma [31].

Klien, et al. (2002), examined the association between cataract surgery of the 10 year incidence in age related maculopathy (ARM). Variables are controlled in age, sex, systolic blood pressure and vitamin uses. Finding of the result had suggested that the cataract baseline was associated with incidence of early ARM (RR, 1.30; 95% confidence interval (CI), 1.04-1.63), soft indistinct drusen (RR, 1.38; 95% CI, 1.08-1.75); increased retinal pigment (RR, 1.38; 95% CI, 1.07-1.79) and progression of ARM (RR, 1.37; 95% CI, 1.06 -1.77). [32] Klien et al. (1995) investigated the relationship of age related maculopathy, cataract surgery and glaucoma to visual visual acuity I the population based beaver dam eye study. Those are find that fifty-seven percent of those who were legally blind at late age related maculopathy in both eyes. The frequency of visual acuity of 20/200 or worse was not significant different in eyes with exudative mascular degeneration (48%) than in eyes with pure geographic atrophy (42%) [33]. Linton, Klien & Klien (1991) investigated the ocular disease ia a population based study of persons aged 43 to 86 years residing in Beaver Dam, Wisconsin. The study was reported that the cataract showed a sensitivity of 20.4% for surrogate by telephone, 30.2% for self-report by telephone and 37.8% for self-report at the examination. Sensitivity of reported age related mascular degeneration was poorer, with the highest rate of 17.9% for the in person self- report [34]. Wang, Foran & Mitchell (2011) investigated the age specific prevalence and causes of bilateral and unilateral visual impairment in older Australian population. The study was suggested that the prevalence of bilateral and unilateral visual impairment was strongly associated with age. Bilateral and unilateral visual impairment prevalence rates were respectively 0.6% and 3.6% for person aged 49-59 years, 1.1% and 8.2% for ages 60-69 years, 5.4% and 20.01% for ages 70-79 years and 26.3% and 52.2% for persons aged 80 + years. Age related maculopathy (ARM) was the predominant cause of bilateral blindness (13/17) and of moderate to severe bilateral visual impairment in persons aged 70+ years. ARM and cataract were jointly most frequent causes of moderate to severe unilateral visual impairment in people aged 70+years [35].

Freeman, et al. (2003) determined their study that cataract surgery is associated with an increased prevalence of age related macular degeneration (AMD) in three independent population based data sets. The result was showed the history of cataract surgery was associated with an increased prevalence of late AMD in all three data sets. The severe cataract in the eye was also associated with a slightly higher prevalence of late AMD [36]. Pollack, Marcovich, Bukelman and Oliver (1996), evaluated the course of age related maculopathy after cataract surgery. Finding of the study suggested that the wet AMD developed in nine eyes (19.1%) that were treated with surgery compared with two fellow eyes (4.3%). Progression of the wet AMD occurred significantly more often in men than in women ($p< 0.05$). soft drusen were found that the significant of ocular risk factor ($p<0.05$) [37]. Fletcher (2010), investigated the cataract and age related macular degeneration (AMD) are the major causes of vision impairment and blindness. Reported the study both condition was strongly associated age related with earlier signs (usually asymptomatic) occurring in middle age and becoming severe and more prevalent with increasing age [38].

The prevalence of glaucoma and maculopathy in our study is 10.36% of those planned for cataract surgery. If these numbers are similar for the rest of the country this approach would result in detection of a large number of those with undiagnosed glaucoma and maculopathy.

Conclusion

For many people in the country the only point of contact with the eye care system is when they seek or are "screened" for cataract surgery inadequate examination at this time is a lost opportunity to detect and treat other non-cataract ocular pathology, hence our approach in eye camps should be on holistic eye examination and comprehensive treatment for all ocular pathologies including cataract. Finally, we are concluded that findings of our study, it was a great accomplishmentof a comprehensive eye appraisal for cataract surgery. There was importance highly useful of therevealing of undiagnosed glaucoma in the urban area of Chhattisgarh in central India population.

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Original Article

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Prevalence of Ocular Morbidities Amongst the Patients of Diabetes Mellitus of More Than 10 Years Duration

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Abstract

Background: Diabetes mellitus is one of the most common non communicable disease and one of the most important public health problems in India. There are many known ocular complications of diabetes, ranging from conjunctivitis to more severe one like diabetic retinopathy, retinal vein occlusion and optic nerve atrophy. *Aim:* The present study was conducted to find out the prevalence of ocular morbidities in type 2 diabetes mellitus of more than 10 years duration. *Material and Methods:* A hospital based cross sectional study was conducted on patients suffering from diabetes mellitus, type 2, for more than 10 years. After initial laboratory investigations, a detailed ocular examination was conducted using auto-refractometer, Snellen's chart, Slit lamp, Schiotz's tonometer. Retinoscopy and fundus examination was also carried out to determine the relevant pathologies. If required, further examinations such as B scan, Gonioscopy were done. *Results:* The most common ocular morbidity noted was cataract (47.61%). More severe complications like, chorio retinal complications were seen in 198 (32.62%) subjects. Other ocular morbidities were refractive errors (25.70%), glaucoma (8.24%), Episcleritis (0.66%), Uveitis (0.49%), Mono neuropathy; 3, 4 or 6th nerve palsy (0.49%). The study has revealed that the duration of diabetes was statistically associated with the diabetic retinopathy ($p<0.001$). *Conclusions:* Diabetes mellitus affects all parts of the visual system.

Keywords: Diabetes Mellitus; Ocular Morbidity; Cataract; Duration of Diabetes.

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Introduction

With increase in the life expectancy and control of major communicable diseases, the morbidity and mortality profile of India is gradually shifting from the communicable diseases to non communicable diseases. Diabetes mellitus is one of the main non communicable diseases determining the health profile of the community. According to WHO, about 19% of the total world diabetic population lives in India. As per an estimate, the number of diabetic population will increase to 80 million by 2030 [1]. India is the diabetes capital of the world with 41 million Indians having diabetes; every fifth diabetic in the world is an Indian [2].

Diabetes mellitus (DM) is an important health problem that induces complications and it causes significant morbidity owing to specific microvascular complications such as, retinopathy, nephropathy and neuropathy, and macrovascular complications such as, ischaemic heart disease, and peripheral vasculopathy [3]. Diabetes mellitus and its complications are rapidly becoming the world's most significant cause of morbidity and mortality [4,5].

There are many known ocular complications of

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diabetes, ranging from conjunctivitis to more severe one like diabetic retinopathy, retinal vein occlusion and optic nerve atrophy [6]. The incidence of these complications amongst diabetes patients depends upon the type of diabetes, its duration, its control, and other patient related factors. There are very few studies which has assessed the prevalence of ocular manifestations of type 2 diabetes mellitus of longer duration. So, the present study was planned to assess the ocular morbidities in diabetes mellitus of more than 10 years duration.

Aims

The present study was conducted to find out the prevalence of ocular morbidities amongst the patients of diabetes mellitus of more than 10 years duration, visiting a tertiary care hospital.

Material and Methods

The study was a hospital based cross sectional study, conducted jointly in the department of Ophthalmology and General Medicine at Ashiwini Rural Medical College Hospital and Research Center, Kumbhari. The study period was between January 2017 and December 2017. The inclusion criteria for the study subjects were as follows

1. Patients suffering from diabetes mellitus, type 2, for more than 10 years.
2. Patients visiting General Medicine OPD or diabetic clinic at the study center.
3. Patients who consent for participation in the study.

The exclusion criteria for the study subjects were

1. Type 1 diabetes patients
2. Diabetic patients, whose diabetes was diagnosed within last 10 years.
3. Patients who do not consent to participate in the study.

The patients who fulfill the inclusion criteria were referred to the ophthalmology department by the general medicine department/diabetic clinic run at the study centre, Before the referral, tests for fasting sugar, PP sugar and HBA1C were done. In the department of ophthalmology the detailed ophthalmic evaluation was done. Visual acuity testing was done by auto-refractometer and by using Snellen's chart. Anterior segment examination was done by using a torch. Slit lamp examination was done to detect any corneal or lens pathology. Intraocular pressure was recorded using Schiotz's tonometer. Retinoscopy and fundus examination was also carried out to determine the relevant pathologies. If required, further examinations such as B scan, Gonioscopy were done. Data of each study subject was collected in a standard proforma.

Statistical Analysis

Continuous variables were summarized with mean and SSD, and categorical variables as percentages. $\chi 2$-test was used to explore associations between categorical variables. Two-tailed tests were performed with the significance level at 0.05. Data was analysed by using SPSS 17 software.

Results

A total of 607 patients, who fulfilled the inclusion criteria, were selected for the study. Of these 607 patients, 313 were males and 294 were females. The age and sex wise distribution of the study subjects is shown below. Maximum numbers of patients were in the age group of 65-70 years followed by 60-65 years (Table 1).

Table 1: Age and sex wise distribution of study subjects

Sr.	Age Group	Males	Females	Total
1	40 - 45	2	0	2
2	45-50	10	11	21
3	50-55	33	25	58
4	55-60	46	35	81
5	60-65	65	74	139
6	65-70	78	84	162
7	70-75	56	35	91
8	> 75	23	30	53
	Total	313	294	607

Table 2 shows the ocular morbidities in study subjects. The most common ocular morbidly was cataract (47.61%). More severe complications like, chorio retinal complications were seen in 198 (32.62%) subjects. Because of multiple pathologies in a subject, the total does not match with the number of subjects.

Table 2: Ocular morbidities in study subjects

Sr	Morbidity	Subjects affected	Pecentage
1	Conjunctivitis	10	1.65
2	Episcleritis	4	0.66
3	Uveitis	3	0.49
4	Refractive errors	156	25.70

5	Cataract	289	47.61
6	Chorio-retinal	198	32.62
7	Glaucoma	50	8.24
8	Mono neuropathy	3	0.49

Table 3 shows the distribution of chorio-retinal pathologies in the study subjects. Diabetic retinopathy was seen in 25.21% of patients.

Table 4 shows the association of duration of diabetes and the diabetic retinopathy. It is evident from the table that the prevalence of diabetic retinopathy increases with the duration of the diabetic. The prevalence was 16.73% for patients with diabetes for 10-14 years duration. The same increased to 41.18% for the patients with diabetes of more than 25 years duration. The association of duration of diabetes and diabetic retinopathy was found to be statistically significant. ($p = 8.90 \times 10^{-5}, < 0.0001$).

Table 3: Distribution of chorio-retinal pathologies in the study subjects

Sr.	Pathology	Subjects affected	Percentage
1	Diabetic retinopathy	153	25.21
2	Vitreous pathology	18	2.97
3	Retinal vein/artery occlusion	6	0.99
4	Retinal detachment	5	0.82
5	Chorioretinitis	2	0.33
6	Macular pathologies	12	1.98
7	Optic nerve atrophy	2	0.33

Table 4: Association of diabetic retinopathy with duration of diabetes

Sr	Duration of diabetes	Total subjects	Diabetic retinopathy	Percentage	P value
1	10 -14	251	42	16.73	< 0.001
2	15 -19	190	51	26.84	
3	20-25	115	39	33.91	
4	> 25	51	21	41.18	

Discussion

The present study was conducted in 607 diabetic patients with the duration of diabetes for more than 10 years, to assess the prevalence of ocular pathologies in them.

The commonest ocular morbidity in the present study was cataract. There were 289 patients with visual impairment due to cataract. Age-related senile cataract is the most common cause of visually significant cataract. Posterior subcapsular cortical cataract is most common form of cataract in diabetic patients [7]. Formation of senile cataracts is accelerated in diabetes, probably due to non-enzymatic glycation and cross linking of modified crystallins. However, the reported prevalence of 47.61 % in the present study was much lower than the prevalence reported by Harding JJ [8].

The present study reported the prevalence of refractive errors as 25.70%, which is much lower than the reported prevalence of Vasuki G et al [9]. Haq et al. reported the prevalence of refractive error as 25% [10]. A Study by Nirmalan et al. [11], reported it as 71.8% and Singh et al. reported it as 40.8% [12]. The vast differences in the prevalence rates were due to the different study settings and vast differences in the socio demographic characteristics of the study subjects.

The study has revealed that 198 patients had retinal and choroidal lesions. The various chorio retinal manifestations were diabetic retinopathy (25.21%), vitreous pathology (2.97%), retinal vein/artery occlusion (0.99%), retinal detachment (0.82%), chorioretinitis (0.33%), macular pathology (1.98%) and optic atrophy (0.33%). The primary cause of microvascular complications of diabetes retinopathy is hyperglycemia and glycosylation of tissue proteins. The reported prevalence of chorio retinal lesions is comparable to that reported by Vasuki G [9] and Narendran et al. [13].

The prevalence of glaucoma was reported as 8.24% in present study. It was higher than the value reported Vasuki G and Beena R. It was also higher than a study by Ramakrishnan et al. The difference in prevalence of glaucoma was due to the fact that present study selected the diabetes patients with duration of more than 10 years. So because of the more duration of diabetes and subsequent aged population selection, the present study reported comparatively higher prevalence.

Other ocular morbidities reported were Episcleritis (0.66%), Uveitis (0.49%), Mononeuropathy; [3,4] or 6th nerve palsy (0.49%). All these findings were comparable with the findings of Narendran et al. and Rush et al. [14].

Conclusion

The study has also pointed out that diabetes mellitus affects every part of visual structure from conjunctiva to optic nerve. The present study also has revealed the high prevalence of

ocular morbidities in diabetes mellitus, especially cataract and chorio retinal pathologies, leading to visual impairment. It has also pointed out that the duration of diabetes was statistically associated with the diabetic retinopathy.

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Conflicts of interest: Nil

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A Clinical and Aetiological Study of Ocular Motor Nerve Palsy

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Abstract

Aim: To clinically evaluate cases of ocular motor nerve palsy and to diagnose their possible aetiological causes as they are often perceived as a sign of serious underlying pathology such as intracranial aneurysms.

Purpose: To clinically evaluate cases of ocular motor nerve palsy so as to make anatomical localization and also to make possible aetiological and pathological diagnosis of the neurological lesion. Anatomical localization and aetiopathological diagnosis of the neurological lesion will help the attending neurologist in better management of the case.

Introduction: Ocular motor nerve palsies may be congenital or acquired, complete or partial, pupil sparing or pupil involving, and isolated or multiple accompanied by signs of more extensive neurological involvement. Precise knowledge of its origin and course from nuclear level to terminal muscles along with associated clinical features helps in localization and management of neurological lesions.

Materials And Methods: 50 consecutive cases of ocular motor nerve palsy attending the outpatient clinic of the department of ophthalmology Malla Reddy Hospital, Malla Reddy Institute of Medical Sciences or referred from other specialties are evaluated and investigated thoroughly as a Prospective, observational, non – interventional and Hospital study study from 1st January 2018 to 31st December 2018. All underwent complete ophthalmological, medical, neurological, otorhinolaryngological and general examination along with complimentary investigations and neuroradiological imaging where ever possible.

Inclusion Criteria: Acquired ocular motor nerve palsy with a recent onset (within two weeks), all age groups and both sexes included, ocular motor nerve palsies associated with other neurological signs and symptoms other than the palsy itself and acceptance of the patients to undergo investigations wherever needed.

Exclusion Criteria: Congenital ocular motor nerve palsy, patients with incomitant squint due to myogenic, myasthenic and restrictive causes, patients who were terminally ill and those palsies secondary to neurosurgical causes were excluded from the study.

Results: Paralyses of the sixth and third cranial nerve were the most common. Complete ptosis and full mydriasis were mostly seen in isolated cases of third carnial nerve palsy. Majority of them are pupil sparing. Common causes were vascular, otorhinolaryngological and trauma. Micro vascular ischemia group as an aetiological factor has good recovery rate and so is the case with pupil sparing oculomotor nerve palsy.

Conclusion: Proper evaluation of cases of ocular motor nerve palsy in close collaboration with other specialists will go a long way not only in localizing the serious neurological lesion and also help in reducing the mortality, morbidity and better management of ocular motility disorder.

Keywords: Isolated Ocular Motor Nerve Palsy; Pupillary Sparing Microvascular Ischemia.

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Introduction

The oculomotor nerve is entirely motor in function; it supplies the superior rectus, inferior rectus, inferior oblique, medial rectus and levator palpebrae superioris, as well as autonomic pupillary sphincter and ciliary muscles of the eye. The most common etiology is ischemia due to diabetes

mellitus. Etiologies causing multiple cranial nerve palsies include head trauma, vascular pathology, tumours and inflammation due to infectious and non-infectious origin. Interaction between various specialists is very essential for the evaluation and management of the oculomotor nerve palsy.

Materials and Methods

After obtaining the approval of the institutional ethics committee, the informed consent from the patients were obtained. The study was conducted for a period of 12 months from January 01.2018 to 31st December 2018. The sample size consisted of 50 cases of oculomotor nerve paralysis, presenting themselves directly to the department of ophthalmology or referred by various other departments were studied and analysed. A standard case protocol was maintained, in the history emphasis was given for drooping of eye lid(s), headache, diplopia, fever, trauma, vomiting, convulsions, history of exposure etc. In past history emphasis was given to diseases such as diabetes mellitus, hypertension, and tuberculosis. Current or past medications if any was noted, any history of addictions was also noted. The visual acuity and colour vision was measured using conventional methods, detailed slit lamp examination, thorough clinical examination was done including symmetry of face, head posture, and extraocular movements in all nine cardinal positions of gaze, Hirschberg's test, cover test, prism cover test and aberrant regeneration were performed. Ptosis evaluation and grading of ptosis if present was done as follows: mild (< 2 mm), moderate (2-4mm) and severe (4-8mm). Size, shape and light reflexes of the pupils were noted, the normal pupillary diameter was standardized to 3 mm. Miosis and mydriasis were considered when the diameter was less than 3mm and greater than 7mm respectively. The degree of anisocoria, if present, was recorded. Physiological anisocoria was ruled out after repeating the measurements in dim light. Detailed fundus examination was done and the findings were recorded. Detailed systemic examination was done with special emphasis to central nervous system, cardiovascular and endocrinological examination. Blood pressure measurement, routine blood investigations including blood sugar levels, erythrocyte sedimentation rate and serum cholesterol, VDRL and HIV antibodies, radiological examination of skull, orbital fissures, optic foramina, paranasal sinuses, computed tomography and MRI–scan were performed wherever indicated. They also underwent otorhinolaryngological examination. All patients were reviewed after two weeks, eight weeks, twelve weeks and at the sixth month.

Inclusion Criteria

Aquired oculomotor nerve palsy with a recent onset (within two weeks), all age groups and both sexes were included, oculomotor nerve palsy associated with other neurological signs and symptoms other than the palsy itself and acceptance of the patients to undergo investigations where ever needed.

Exclusion Criteria

Congenital oculomotor nerve palsies, patients with incomitant squint due to myogenic, myasthenic and restrictive causes, patients who were terminally ill, oculomotor nerve palsy secondary to neurosurgery were excluded from the study.

Results

Table 1: Percentage of incidence of oculomotor nerve Palsy

Total No. Of patients seen in OPD from January 2018 to December 2018.	**40151**
Total No. Of oculomotor nerve palsies examined	50
Percentage Of Incidence	0.12453

The percentage of incidence of oculomotor nerve palsy in the present study is 0.12453% (Table 1).

Table 2: Gender incidence

Sex	Number	Percentage
Male	18	36
Female	32	64

There is a female preponderance in incidence (Table 2).

Table 3: Age incidence

Age Group	Number	Percentage
21-30	6	12
31-40	8	16
41-50	9	18
51-60	14	28
61-70	10	20
>70	3	6

Highest incidence is seen in 51-70 age group (48%) (Table 3).

Table 4: Laterality

Laterlity	Number	Percentage
Unilateral	41	82
Bilaterral	9	18

Unilateral incidence is more (82 %). All the cases with bilateral oculomotor nerve palsy had lesions located in the midbrain involving the oculomotor nucleus complex (Table 4).

Table 5: Mode of presentation of oculomotor nerve palsy

Type of Invovement	Number	Percentage
Isolated Nerve Palsy	38	76
Multiple cranial nerve palsy	12	24

Incidence of isolated third nerve palsy is more (76%) (Table 5).

Table 6: Classification of patients by pupil involving / pupil sparing

Pupil Involving / Pupil Sparing	Casess	
	Number	Percentage
Pupil involving	18	36
Pupil sparing	32	64

Incidence of pupil sparing palsy is more (64%) (Table 6).

Table 7: Oculomotor nerve palsy according to aetiology

Aetiology	Number	Percentage
Microvascular ischemia	24	48
Posttraumatic	7	14
Intracranial anesurysm	1	2
Neo plasm	4	8
Orbital inflammatory group	7	14
Undertermind cause	7	14

Incidence of microvascular ischemia as a aetiological factor is more (48%) (Table 7).

Table 8: Oculomotor nerve palsy due to systemic vascular deseases.

Systemic Desease	Number	Percentage
Diabetes	23	46
Hypertension	05	10

Incidence of diabetic palsy is more (46%) among systemic aetiological factors (Table 8).

Table 9: Symptoms

Symptoms	Number	Percentage
Visual impairment	7	14
Ptosis	22	44
Diplopia	16	32
Ocular deviation	36	72

Ocular deviation as a symptom is of higher incidence (72%) (Table 9).

Table 10: Ptosis

Symptom	Number	Percentage
Total number of cases with ptosis	23	46
Mild ptosis	10	43.43
Moderate ptosis	6	26.08
Complete ptosis	7	30.43

Incidence of ptosis is about (46%) among which milder ptosis incidence is higher (43.43%) (Table 10).

Table 11: Recovery Pattern in Isolated OMNP according to Aetiology

Aetiology	Complete Recovery		Partial Recovery		Lost During Followup	
	No.	%	No.	%	No.	%
Micro Vascular Ischemia	18	47.36	6	16.78	-	-
Post Traumatic	-	-	6	15.78	-	-
Intracranial Aneurysm	-	-	-	-	01	2.63
Benign Third Nerve Palsy	02	5.26	-	-	-	-
Undetermined Group	03	7.89	03	7.89	-	-

Complete recovery is seen more in microvascular ischemia as an aetiological factor (Table 11).

Table 12: Recovery pattern in OMNP associated with multiple cranial nerve palsy according to aetiology of palsy

Aetiology	Complete Recovery		Partial Recovery		Lost During Followup	
	No.	%	No.	%	No.	%
Orbital inflam-mantory group	5	41.66	03	25	-	-
Post traumatic	-	-	02	16.66	-	-
Neoplasm	-	-	-	-	02	16.66

Complete recovery in multiple cranial nerve palsy is seen more in orbital inflammatory group as aetiological factor (Table 12).

Table 13: Recovery pattern according to pupillary involvement

Pupillary Involvement	Complete Recovery		Partial Recovery		Lost During Followup	
	No.	%	No.	%	No.	%
Pupil spared	23	46	9	18	-	-
Pupil involved	-	-	12	24	6	12

Pupil sparing palsys show higher complete recovery incidence (46%) (Table 13).

Discussion

Table 14: Age incidence

Study	Age Group	Percentage
Present Study	51 To 70 Years	48
Vimala Menon And Co-Workers	11 To 40 Years	71

In the present study maximum number of patients belonged to between age group 51 to 60 years 28% (fourteen patients) and 61 to 70 years 20% (ten patients), while VIMALA MENON and co-workers found maximum incidence of oculomotor nerve palsy (71%) in the 11 to 40 years age group [1]. (Table 14).

Table 15: Gender incidence

Study	Male	Percentage	Female	Percentage
Present Study	18	36	32	64

Out of 50 patients, 64% (32patients) were females and 36% (eighteen patients) were males. Green and co-workers have reported equal sex distribution [2].

Unilateral oculomotor nerve palsy was seen in 82% (Forty one) patients, out of which right eye oculomotor nerve palsy was observed in 75.60% (thirty one) patients, left eye oculomotor nerve palsy was observed in 24.39% (ten) patients and 18% (nine) patients had bilateral oculomotor nerve palsy, the results could be compared to earlier studies by Green and co-workers and Rush and Younge [2,3]. (Table 15).

Table 16: Isolated oculomotor nerve palsy

Study	Percentage
Present study	76
Ruker	68.5
Richards and co-workers	68.1

In the present study the number of isolated oculomotor nerve palsy is 76%, compared to studies by Rucker 68.5% and Richards and co-workers 68.1 % [4,5] (Table 16).

Table 17: Predominant cause oculomotor nerve palsy

Study	Cause	Percentage
Present Study	Microvascular Ischemia	48

Studies by Green and workers, Rush, Rucker and Younge found similar results. In the present study, Microvascular Ischemia (48%) emerged as the predominant cause for oculomotor nerve palsy where a specific aetiology could be determined, which could be compared to most of the earlier studies who have found similar results [2,5] (Table 17).

Table 18: Post – traumatic oculomotor nerve palsy

Study	Percentage
Present study	14
P.Muthu And P.Pritty	15
Rush and Younge series	16.2
Richards and Younge series	14.7

Post-traumatic oculomotor nerve palsy accounted for 14% of total cases in the present study, compared to a study by P. Muthu and P. Pritty in June 2000,they found a 15% occurrence of isolated 3rd nerve palsy attributable to head trauma [6]. Rush and Younge series (16.2%) [3], and Richards and Younge series (14.7%) [5] (Table 18).

Table 19: Idiopathic orbital inflammatory group as cause of omnp.

Study	Percentage
Present study	14
Vimala menon series	9.5

In the present study, idiopathic orbital inflammatory group comprised of 14% cases, compared to vimala menon series (9.5%), [1] only such study where orbital inflammatory diseases were considered as a separate group (Table 19).

Table 20: Intracrainal neoplasms as a cause of omnp

Study	Percentage
Present study	8
Vimala menon series	9.5

Intracranial Neoplasms were suspected in 8% of cases, compared to Vimala Menon [1] series (9.5%). (Table 20).

Table 21: Intracranial aneurysms as cause of omnp

Study	Percentage
Present Study	2

Studies by Rush, Rucker and YOUNGE had higher incidence. Intracranial aneurysms causing oculomotor nerve palsy were diagnosed in only 2% of cases in the present study while most of the earlier studies [3,4,5,7] had higher incidence of aneurysms (Table 21).

Table 22: Undetermined aetiology as a cause of omnp

Study	Percentage
Present Study	14

In The Present Study, Etiology Was Undetermined In 14% Cases (Table 22).

Table 23: Complete recovery of omnp

Study	Percetnage
Present study	46
V.P.Singh Et Al	50
Rush and younge	44.6

In the present study complete recovery was seen in 46% of cases compared to earlier studies by V.P. Singh et al. [9] (50%) and Rush and YOUNGE series (44.6%) [3] (Table 23).

Table 24: Micro vascular group as a cause for best recovery in omnp.

Study	Percentage
Present Study	48

Study by Rush and Younge series show comparable results. Microvascular ischemia group had the best recovery (48%) which is comparable to previous study by Rush and Younge series [3] (Table 24).

Table 25: Pupil sparing/involving for complete recovery of omnp.

Pupil	Percentage of Complete Recovery
Pupil Sparing	64
Pupil Involving	36

Pupil sparing ocular motor nerve palsy (64%) had better prognosis for complete recovery compared to (36%) pupil involving ocular nerve palsy (Table 25).

Conclusion

Isolated oculomotor nerve palsy is the predominant mode of presentation which has a good recovery rate, microvascular ischemia appears to be the major etiological factor and the prognosis for complete recovery is good, but when oculomotor nerve palsy is associated with multiple cranial nerve palsies or other neurological features, the chance of complete recovery is less. Even though certain etiological factors such as microvascular ischemia can be done using simple laboratory investigations, interaction with other specialists helps in guiding the diagnosis, evaluation, in predicting prognosis and efficient management.

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Study of Efficacy and Safety of 5-Fluorouracil in Trabeculectomy

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Abstract

Background: In majority of cases of glaucoma the disease progresses in such a slow symptomfree course, that by the time patient, seeks help from the ophthalmologist, a great deal of permanent damage has occurred already. Thus, delay on the part of patient in many cases is due to his ignorance about glaucoma. The present study was undertaken to assess the efficacy & safety of intraoperative 5 – Fluorouracil in Trabeculectomy.

Methods: The present study was undertaken in the Department of Ophthalmology, ARMCH & RC, Kumbhari and cases which were diagnosed clinically as having primary glaucoma with raised intraocular tension were randomly selected to receive or not to receive intraoperative 5 – Fluorouracil application between conjunctival flap and sclera for 1 minute duration.

Results: There was 67% reduction in baseline intraocular tension with intraoperative use of 5 – Fluorouracil while 58% reduction in baseline intraocular tension was observed without use of 5 – Fluorouracil. Intraocular tension was controlled below 15 mmHg in 92% cases with intraoperative use of 5 – Fluorouracil and 64% cases without use of 5 – Fluorouracil. In high risk glaucoma, adequate control of intraocular tension was observed with intraoperative use of 5 – Fluorouracil.

Conclusion: It is a safe and effective alternative to subconjunctival injections of 5 – Fluorouracil. It is also useful in controlling the intraocular tension in high risk eyes.

Keywords: Glaucoma; Trabeculectomy; 5-Fluorouracil; Visual Acuity; Bleb.

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Introduction

In majority of cases of glaucoma the disease progresses in such a slow symptomfree course, that by the time patient, seeks help from the ophthalmologist, a great deal of permanent damage has occurred already. Thus, delay on the part of patient in many cases is due to his ignorance about glaucoma.

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Nearly 1 in 10 blind persons in the world is blind due to glaucoma. Extensive literature on its incidence has been built up over the past century. Various survey's reveal that 1-2% of the population over the age of 40 years have glaucoma and its incidence increases with age.

In a country like India, where patient finds it difficult to stick to a strict regime of putting medicines in the eye at frequent intervals for the rest of their lives or are financially handicapped causing inability to buy medicines for a long period of time or do not enjoy the facility of a nearby eye centre for periodic check up. Surgery is preferred to medical treatment in many cases.

Lowering the IOP effectively decreases the development of glaucoma due to evidence-based medicine to glaucoma, several prospective, randomized trials are carried out and treatment of glaucoma seems simple [1,2].

Any operation devised for the relief of glaucoma should ideally be such as to preserve the function of the eye, maintain the intraocular tension within normal limits and retain the integrity of the globe [3]. The various types of operations advocated from time to time proved that this idea has never been attained.

Trabeculectomy or removal of trabecular meshwork was first described by Cairns [4] in 1968. He reflected the corneoscleral flap posteriorly. It allows the aqueous to flow through the now exposed cut ends of Schelmm's canal, and then leave the eye via normal exit channels.

Later in 1970, it was modified by P.G. Watson. He reflected the comeoscleral flap anteriorly and advised iridectomy in all cases [5].

It is observed that in trabeculectomy there is failure to maintain the intraocular tension below target level over a prolonged period of time in eyes which are high risk for surgical failure, such as pseudoexfoliation glaucoma, topical use of antiglaucoma drugs for more than three years and secondary glaucoma. Such failure occurs due to excessive scarring at the trabeculectomy site due to fibroblast proliferation resulting in non–filtering bled.

To prevent such scarring, intraoperative use of 5 – Fluorouracil was first suggested by Heur et al. 1984 as subconjunctival injections of 5 – Fluorouracl, these subconjunctival injections were associated with serious comeal complications like comeal epithelial defect, ulceration and endophthalimitis [6]. To avoid these complications Doyle J et al. first suggested the use of 5- Fluorouracil as sponge application between conjunctival flap and sclera [7]. Considering the facts, the present study was planned to determine the efficacy & safety of intraoperative 5 – Fluorouracil in Trabeculectomy

Objectives

To study the efficacy & safety of intraoperative 5 – Fluorouracil in Trabeculectomy.

Material And Methods

This study was undertaken in the Department of Ophthalmology, ARMCH & RC, Kumbhari. Informed written consent under guarded visual prognosis was obtained from all patients. Intraocular tension was recorded by using Schiotz tonometer. 50 cases were operated for Trabeculectomy by using following two methods.

1. 25 cases with intra – operative use of 5 – Fluorouracil.
2. 25 cases without use of 5 – Fluorouracil

Selection Criteria

Cases which were diagnosed clinically as having primary glaucoma with raised intraocular tension were randomly selected to receive or not to receive intraoperative 5 – Fluorouracil application between conjunctival flap and sclera for 1 minute duration.

Criteria for Success

Achieving the mean intraocular tension, which is not harmful to the eye. i.e. less than 20 mmHg post operatively.

Detail history and clinical examination was done on following lines.

Every patient was subjected for retinal examination by opthalmoscopy of both eyes for optic disc changes. In every patient sac syringing was carried out to see the patency of the sac. Visual acuity was recorded of both eyes. Routine investigations were done. Initially, high levels of intra – ocular tension was treated by Tab – Acetazolamide 250 mg 2 stat & then by bid.

5 – Fluorouracil

The most common cause for failure of filteration surgery is excessive scarring at the filteration site resulting in a non – filtering bleb.

5 – Fluorouracil is a fluorinated pyramidine analogue, a potent antimitotic, antimetabolic agent. It competitively ibhibits thymidylate synthetase and cell division thereby decreasing the fibroblast proliferation.

Procedure

Procedure was performed under local Anaesthesia. Painting & drapping was done. Superior rectus suture was taken. A limbal/ Fornix based conjunctival flap was raised. A cellular sponge soaked in 50 mg /ml solution of 5 – Fluorouracil was placed between conjunctival flap and sclera for 1 minute. After 5 – Fluorouracil application conjunctival flap and sclera was copiously washed with 20 ml Ringer lactate solution. Triangular 2/3 thickness 4 mm x 3mm x 3 mm outer sclera flap was raised. Anterior chamber entry was done with 11 number blade & peripheral

buttonhole iridectomy performed. An inner block of trabecular tissue 1 mm x 5 mm in size excised. Scleral flap re-apposed with interrupted 10-0 nylon sutures. The conjunctival flap was sutured with 8 – o black silk. Subconjunctival injection of gentamicin + dexamethasone + atropine was given in inferior fornix. Chloramphenicol eye ointment was put. Eyepad & shield was given.

Trabeculectomy Bled

After Trabeculectomy the control of intraocular tension depends upon the type of bleb formed. When the bleb is diffusely formed, elevated, and with increased microcystic conjunctival changes with decreased vascularity is associated with good control of intraocular tension.

All the patients were examined at the time of discharge by routine eye examination, visual acuity fundoscopy & slit lamp examination. Every patient was followed up weekly for one month and then monthly for 6 months.

Statistical Analysis

Descriptive statistics such as mean, SD and percentage was used to present the data. Comparison between groups was performed by using t-test for quantitative data and chi-square test for qualitative data. A p-value less than 0.05 were considered as significant.

Results

Table 1: Age and Sexwise distribution of patients

Sex	Age in Years					Total
	31-40	41–50	51–60	61–70	71 & above	
Male	01	07	05	05	02	20
Female	03	07	12	08	00	30
Total	04	14	17	13	02	50

Most of the patients were evenly distributed in the Fifth, Sixth and Seventh decade. Highest number of patients were in the Fifth and Sixth decade indicating glaucoma is more common in Fifth and Sixth decade (Table 1).

Out of 50 glaucoma patients 62% were of open angle glaucoma, 36% were of closed angle glaucoma and 2% patients of secondary glaucoma, thus confirming that prevalence of open angle glaucoma is more in the community (Fig. 1).

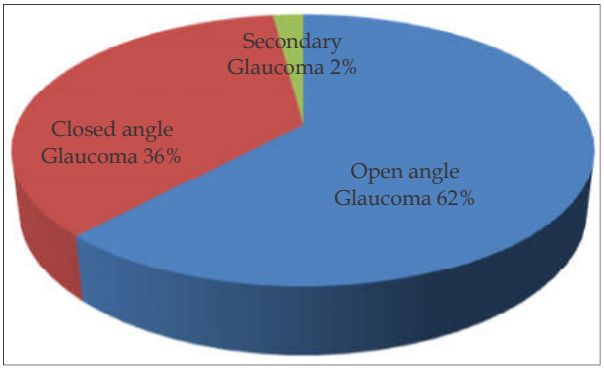

Fig. 1: Type of glaucoma

Table 2: Type of glaucoma according to sex

Sex	Type O Glaucoma			Total
	Open Angle Glaucoma	Closed Angle Glaucoma	Secondary Glaucoma	
Male	16	04	---	20
Female	15	14	01	30
Total	31	18	01	50

Above table 2 indicates that open angle glaucoma is evenly distributed in both sexes while closed angle glaucoma is three times more common in females.

In Trab with 5 – Fluorouracil group, 8% patient were in 6/6 – 6/12 group, 12% patient were in 6/18 – 6/24 group, 4% patient were in 6/36 – 6/60 group, and 56% patient were in PL + PR + to No PL group. In 1 patient of ACG visual acuity was improved from Fc 3 mt to 6/60 (Table 3).

Table 3: Pre- operative and post – opoerative visual acuity status in trabeculectomy with 5 – fluorouracil.

Visual Acuity	With 5 – Fluorouracil		Without 5 - Fluorouracil	
	Pre-Operative	Post-Operative	Pre-Operative	Post-Operative
6/6 – 6/12	02	02	03	03
6/18 – 6/24	03	02	10	10
6/36 – 6/60	01	03	05	06
Fc 5 mt – Fc 3 mt	04	03	01	-
Fc 2 mt – Fc 1 ft	01	01	02	02
PL + PR + to No PL	14	14	04	04

In Trab without 5 – Fluorouracil group, most of the patients had visual acuity above 6/60 and approximately 40% cases were in the 6/18 – 6/24 group. 1 patient of ACG improved from Fc 4 mt. – 6/60 while in other 6 cases improvement of visual acuity occurred by 1 Snellen's line (Table 3).

elevated avascular with conjunctival microscopic changes.

Bleb formation was seen in 100 % cases, Blebs seen without intraoperative use of 5 – Fluorouracil were shallow diffuse blebs with relative vascularity at bleb site (Table 5).

Table 4: Post–operative intraocular tension control in trabeculectomy with 5–fluorouracil & without 5–fluorouracil

Pre–Op Intraocular Tension In Mmhg	No. of Cases	Controlled Post Op Intraocular Tension 10-20 Mmhg	Percentage
With 5 – Fluorouracil			
20 – 40 mmHg	16	16	100%
41 – 60 mmHg	08	06	75%
61 – 80 mmHg	01	01	100%
Intraocular tension			
(Mean + SD)	40.19 + 12.89 mmHg	13.78 + 2.62 mmHg.	
Without 5 – Fluorouracil			
20 – 40 mmHg	16	16	100%
41 – 60 mmHg	09	06	75%
61 – 80 mmHg	--	01	100%
Intraocular tension			
(Mean + SD)	37.56 + 9.78 mmHg	15.75 + 2.86 mmHg	
p-value	0.42	0.01	

In with 5–Fluorouracil group one case of absolute glaucoma failed completely with minimal hyphema throughout post – operative period and secondary glaucoma formation. While a case of secondary glaucoma had post – operative intraocular tension of 21.8 mmHg, 21.8 mmHg at second and third Month respectively.

In without 5–Fluorouracil group, one patient of POAG there was rise in intraocular tension as 21.8 mmHg at first and second month and 25.8 mmHg at third month.

There is no statistically significant difference of mean intraocular tension between with and without 5-Fluorouracil groups (p=0.42) in pre-operative whereas there is statistically significant difference of mean intraocular tension between with and without 5-Fluorouracil groups (p=0.01) in post-operative (Table 4).

Table 5: Type of bleb formed in trabeculectomy with 5 – fluorouracil & without 5 – fluorouracil

Type of Bleb	With 5 – Fluorouracil (%)	Without 5 – Fluorouracil (%)
Diffuse elevated bleb	23 (92)	24 (96)
Shallow diffuse bleb	02 (08)	01 (04)
Flat bleb	--	--
Encapsulated bleb	--	--

Bleb formation was seen in 100% cases with 5 – Fluorouracil Conjunctival blebs seen with intraoperative use of 5 – Fluorouracil were diffusely

Discussion

We have used the 50 mg/ml concentration of 5 – Fluorouracil intraoperatively by applying a surgical sponge soaked in 5–Fluorouracil solution between the conjunctiva and sclera for 1 minute duration to prevent the fibrosis which causes failure of filtration surgery over a prolonged period of time.

Age and Sex Distribution

Most of the patients were from the fifth, sixth and seventh decade. Highest number of patients 17 i.e. (34%) were in the age group of 51-60 years. Mean age of the patients in the Trabeculectomy with 5–Fluorouracil group was 55.28+10.20 years and 57.32 + 8.5 in the Trabeculectomy without 5–Fluorouracil group.

According to Becker Shaffer's, incidence of POAG increases after 40 years of age and most common in 5th & 6th decade [8].

Type of Glaucoma

Out of 50 cases of glaucoma 31 cases (62%) were of open angle glaucoma and 18 cases (36%) were of closed angle glaucoma and 1 case (2%) of secondary glaucoma, thus indicating that open angle glaucoma is more common in the community.

P.A. Lamba have noted 36% patients with open angle glaucoma and 64% patients with chronic

angle closure glaucoma [9].

Peter R Egbert in his study of 55 patients noted that, 51 patients had open angle glaucoma, 2 patient had chronic angle closure glaucoma while 2 patients had angle recession glaucoma after trauma [10].

Secondly, out of 31 cases of open angle glaucoma, 14 were males and 17 were females thus indicating that open angle glaucoma having approximately equal prevalence in both sexes.

Our findings correlate to Ruderman's study in which 40% POAG patient were male and 60% patients POAG patients were female [11].

Out of 18 cases of closed angle glaucoma 4 were males (23%) and 14 were females (77%) thus indicating that closed angle glaucoma is three times more common in females than males, due to typical anatomical predisposition of hypermetropic eye with small anterior chamber. Duke Elder reported that angle closure glaucoma is twice more common in females than males [3]. According to Becker Shaffer's angle closure glaucoma is two or three times more common in females than males [8].

Visual Acuity

Preoperative visual acuity records shows that in trab with 5 – Fluorouracil group, 2 patients (8%) were in 6/6 to 6/12 group, 1 patient (4%) in the 6/36 to 6/60 group, 4 patients (16%) in the FC 5 mt to FC 3 mt group, 1 patient (4%) in the FC 2 mt to FC 1 ft group and 14 patients (56%) in PL (+) PR + to NO PL group.

In trab without 5 – Fluorouracil group, 3 patients (12%) were in 6/6 to 6/12 group. 10 patients (40%) were in the 6/18 to 6/24 group, 5 patients (20%) in the 6/36 to 6/60 group, 1 patient (4%) in the FC 5 mt to FC 3 mt group, 2 patients (8%) in the FC 2 mt to FC 1 ft group and 4 patients (16%) in the PL (+) PR X to No PL group.

In this study with intraoperative use of 5 – Fluorouracil, out of 25 patients 4 patient (16%) had improvement in visual acuity of 1 or 2 Snellen's lines. Two patients of angle closure glaucoma had improvement in the visual acuity of 2 and 3 Snellen's lines respectively, while two patients of chronic simple glaucoma had improvement in visual acuity of one Snellen's line. 21 patients (84%) had stable visual acuity postoperatively.

In Trabeculectomy without intra-operative use of 5–Fluorouracil (40%) had visual acuity in the range of 6/18 to 6/24, out of 25 patients, 7 patients (28%) had improvement in visual acuity of 1 or 2 Snellen's lines and were stable in 18 patients (72%) post operatively. Out of these 7 patients, 6 were of angle closure glaucoma while one patient of chronic simple glaucoma showed improvement in visual acuity by 1 Snellen's line.

Our results are comparable to Lumina Lanigan Jorg Sturmer et al. in their study, visual improvement occurred in 12 % patients, deterioration of visual acuity was seen in 21% cases and visual acuity was stable in 68% cases with intraoperative use of 5–Fluorouracil [12].

Our results do not correlate to Mielke C, who observed loss of visual acuity of more than two Snellen's line in 6 eyes (7.9%) in the 5–Fluorouracil group and in 4 eyes (5.17%) in the control group while in our study none of the patient had loss of visual acuity [13].

Kuldev Singh noted improvement in visual acuity of more than 2 Snellen's lines in 3 patients (8.1%) and worsening of visual acuity by 2 snellen's lines in 7 patients (18.9%) while visual acuity was stable in 27 patients (73%) with intraoperative use of 5 – Fluorouracil [14].

V.L. Membrey reported loss of 2 Snellen's lines of visual acuity in 15–20% cases with itnraoperative use of 5–Fluorouracil due to progression of lens opacities and hypotonous maculopathy [15].

Intraocular Tension

In Trab with 5–Fluorouracil group, 16 patients (64%) had intraocular tension in the range of 20-40 mm Hg and 8 patients (32%) had intraocular tension between 41-60 mm Hg while 1 patient (4%) had intraocular tension between 61-80 mm Hg.

In Trab. Without 5–Fluorouracil group 16 patients (64%) had intraocular tension in the range of 20-40 mmHg and 9 patient (36%) had intraocular tension between 41-60 mmHg.

Mean preoperative intraocular tension in the trab with 5–Fluorouracil group was 40.19 + 12.89 mmHg while in trab without 5–Fluorouracil group mean preoperative intraocular tension was 37.56+ 9.78 mmHg.

Our mean preoperative intraocular tension values correlate to P.A. Lamba's study with mean preoperative intraocular tenson in 5–Fluorouracil group was 42.72+3.7 mmHg and 40.4+6.1 mmHg in the control group [9].

Our Pre-operatively intraocular tension values do not correlate with Peter R Egbert's study with mean preoperative intraocular tension of 29.2

(18-46) mmHg in the 5–Fluorouracil group and 33.4 (16.76) mmHg in the control group [10]. 5–Fluorouracil was used intraoperatively in this study for achieving the low levels of intraocular tension and maintaining the patency of functional bleb over prolonged duration of time.

In this study intraocular tension recorded at each follow up post–operatively–mean preoperative intraocular tension in the 5–Fluorouracil group was 40.19+12.89 mm Hg while it was 37.56+9.78 mm Hg in the trab without 5–Fluorouracil group.

Mean post–operative intraocular tension in the 5 –Fluorouracil group at last visit (about 6th month) was 13.78+2.62 mmHg and 15.75+2.6 mmHg without use of 5 – Fluorouracil.

There was 67% reduction in intraocular tension with intraoperative use of 5–Fluorouracil and 58% reduction in intraocular tension in trab without use of 5–Fluorouracil.

Our results correlate to findings of Anand N who observed intraocular tension less than 21 mm Hg for all eyes was 93% and 81% with intraopertive use of 5–Fluorouracil in low risk and high risk groups [16].

Our findings were not correlated with Peter R Egberts observation of intraocular tension less than 20 mmHg or less in 71% eyes with intraoperative use of 5–Fluorouracil and 32% eyes without use of 5–Fluorouracil because our success rate is greater in both groups as 96% in Trab with 5–Fluorouracil and 96% in trab without 5–fluorouracil group respectively [10].

If the criteria for success was intraocular tension 15 mmHg, or less 12 out of 25 cases (88%) in the 5 – Fluorouracil group had intraocular tension less than 15 mmHg while 16 out of 25 patients (64%) had intraocular tension less than 15 mmHg at 6 months.

Our results confirms findings of Lamba et al who observed 90.9% (intraocular tension 15.8 mm Hg) success rate with intraoperative 1 minute use of 5 –Fluorouracil while 66.7% (intraocular tension 18.3 mm Hg) without use of 5–Fluorouracil [9].

Anand N with intraocular tension of less than 15 mmHg documented that low risk group had significantly longer survival rate than high risk group [16].

Our results are not correlated with Peter R. Egbert's study with intraocular tension of 15 mm Hg or less 46% patients in the 5–Fluorouracil group and 16% in the trab without 5–Fluorouracl group had intraocular tension less than 15 mm Hg while in our study 88% patients in the 5–Fluorouracil group and 64% patients in the trab without 5–Fluorouracil had intraocular tension less than 15 mm Hg [10].

Our results are comparable to study conducted by Detry Morel M, who reported overall success rate of 94% with intraoperative use of 5–Fluorouracil [17] and by Lanigan who reported 94% success rate with intraoperative use of 5–Fluorouracil [12].

Bleb Formation in Trabeculectomy without 5–Fluorouracil:

In Trabeculectomy successful outcome usually demonstrate a reasonable bleb during the first week. In trab without 5 – Fluorouracil there was flat bleb on 1st post operative day which gradually became little diffuse with persistant hyperemia towards the end of the first week, with obscure borders.

The bleb tends to be more localized in the 2nd and 3rd week with persistant hyperemia, little elevated with obscure margins. At the end of one month the bleb was well established, hyperaemic, moderately diffuse with distinct margins. In the 2nd month bleb become more diffuse with some decrease in the hyperemia and distinct borders. Towards the end of 3rd month bleb was shallow diffuse elevated and some hyperaemia remaining in the wall of the bleb, with small microcystic changes visible on the conjunctival epithelium in few cases by slit lamp examination. At the last follow – up about six months, most of the patient had shallow diffuse bleb extending over 2-3 clock hours with presence of blood vessels in the wall of the bleb in most of the cases and evidence of microcystic changes in the conjunctival epithelium with slit lamp examination.

In most cases of Trabeculectomy without intraoperative use of 5 – Fluorouracil type II i.e. shallow diffuse bleb was formed with relative avascularity.

It was flat on first post – operative day. In this type bleb became diffuse towards the end of first week with no increase in the hyperemia of the conjunctiva. Towards the end of 2nd week bleb became more diffuse, much elevated and extending over longer area than the Trabeculectomy without 5–Fluorouracil. At the end of 3rd week the bleb was diffuse more localized with distinct borders and much avascular than trab without 5–Fluorouracil. At the end of 1 month use the bleb was more diffuse elevated extending over 3-4 clock hours and relatively avascular than trab without 5–Fluorouracil with distinct margins. At the end of

2nd month bleb was more diffuse elevated and with presence of minimal vessels on wall of the bleb with few microcystic changes seen in the wall of the conjunctiva. At the end of 3rd month most of the cases has diffuse elevated avascular bleb extending over 3-4 clock hours with more microcystic changes seen in conjunctival epithelium.

With the passage of time, bleb became more diffuse extending over larger area, elevated and again decreases in the vascularity. At the end of 6th month there was diffuse elevated bleb with microcystic changes in the conjunctival epithelium indicating good drainage of aqueous through the conjunctiva.

In both the groups bleb was formed in all cases. In two cases cystic bleb was formed with intraoperative use of 5–Fluorouracil at 6 months. It was diffuse elevated avascular bleb with large cystic spaces in the conjunctival epithelium. There was no evidence of leak through bleb by negative Schidel's test. In these two patients there was minimal migration of bleb over cornea. Total migration of bleb all around the cornea giving bogginess to cornea was not observed in any case. In one case of absolute glaucoma and other case of secondary glaucoma the bleb was shallow, diffuse with vascularity at bleb site. In one patient of chronic angle closure glaucoma operated for trab without 5–Fluorouracil had bleb migration over cornea in both eyes while left eye had developed cystic bleb causing discomfort to the patient.

Bleb Formation in Trabeculectomy with 5–Fluorouracil

In case of trab with 5-Fluorouracil diffuse elevated and more avascular blebs were formed because single intraoperative 5–Fluorouracil application during Trabeculectomy caused reversible inhibition of fibroblast proliferation which resulted into absence of collagen which is formed fibroblast. Collagen was required for the process of angiogenesis. Hence due to absence of collagen new vessels are not formed at bleb site and avascularity is enhanced. While aqueous flow caused regression of remaining vessels adding to avascularity. Due to decreased amount of fibrosis there was less obstruction to flow of aqueous and the blebs tend to remained more diffuse with microcystic conjunctival changes, promoting the filtration of more aqueous in these cases for longer duration.

Our findings are consistent with the Shelat et al who observed diffuse avascular blebs with intraoperative use of 5–Fluorouracil [18]. Our findings correlate to Lachkar who noted consistently higher blebs with intraoperative use of 5–Fuorouracil than placebo [19].

Conclusion

To conclude, intraoperative use of 5–Fluorouracil in trabeculectomy is a safe and effective alternative to subconjunctival injections of 5–Fluorouracil. It is also useful in controlling the intraocular tension in high risk eyes.

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Original Article

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Central Corneal Thickness an Important Factor in Normal Tension Glaucoma, Primary Open Angle Glaucoma and Ocular Hypertension

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Abstract

Introduction: Central corneal thickness is an important parameter in confirming the final IOP of a patient. There are various techniques employed in measuring CCT. Most commonly used is the ultrasonic pachymetry. *Aims:* To compare the CCT values of NTG, POAG, OHT patients with controls and to determine the effect of CCT on diagnosis and management of glaucoma patients. *Methods and Materials:* A total of 99 patients (37 controls, 22 NTG, 28 POAG and 12 OHT) were included in the study. CCT was done for all patients using Ultrasonic pachymeter. CCT corrected IOP using linear regression formula was used to re classify the patients and glaucoma therapy was given accordingly *Results:* Mean CCT in NTG (503.91±11.31) patients was significantly lower than the controls (527.65±21.90) and POAG (525±23.59) patients where as CCT in OHT (572.50±22.71) patients was significantly higher than the controls and POAG patients. No statistically significant difference was found between POAG and controls. Measurement significant changes of 27.27%, 21.43%, and 66.67% were foundin NTG, POAG and OHT patients respectively. 12.89% of glaucoma patients were advised a change in glaucoma treatment plan, 22.73% of NTG patients were reclassified as POAG and 25% of OHT patients as normal after the correction of IOP for CCT. *Conclusion:* The mean CCT is decreased in patients with normal tension glaucoma when compared with controls and POAG patients, which confirms the findings of other investigators. This leads to underestimation of their IOP and misdiagnosis. The measurement of CCT is necessary for classification and adequate treatment of glaucoma patients.

Keywords: CCT; OHT; POAG; NTG.

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Introduction

Glaucoma is an optic neuropathy with characteristic appearance of optic disc and specific pattern of visual field defects that is associated frequently but not invariably with raised IOP. Risk factors for glaucoma include elevated IOP, heredity, myopia and race. Even though factors other than IOP are involved, IOP is the most important risk factor because it is the only risk factor which we can pharmacomodulate to date.

Studies by Cartwright and Anderson in NTG patients with asymmetric IOP have shown that glaucomatous damage was greater in the eye with higher IOP [1]. Visual field loss of patients whose IOP is lowered by whatever means is usually slowed [2]. Most glaucoma patients appear to have abnormal sensitivity to IOP that may be offset if IOP is lowered to mid normal or low normal range and perhaps 90% or more may benefit from sufficiently low IOP.

Goldmann Applanation tonometry has been considered to be the gold standard for measurement of IOP. Ehlers and associates have shown that central corneal thickness affects the accuracy of applanation tonometry. Reduced corneal thickness of 0.45mm could produce an underestimation of

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IOP by up to 4.7 mm Hg, whereas an increased CCT of 0.59 mm could cause an overestimation of 5.2 mm Hg when the actual IOP is 20 mm Hg [3]. Therefore in individuals with thick cornea, IOP measurement by GAT may show falsely high readings and for thin cornea low readings.

CCT would be an important factor to be evaluated when assessing target IOP levels for the management of glaucoma and also during follow up. Shih CY et al. concluded that central corneal thickness has significant effect on the clinical management of patients with glaucoma and glaucoma suspects [4].

Studies by Copt RP, Thomas R, Mermoudand several other authors have shown that CCT in patients with normal tension glaucoma is lower and ocular hypertension is higher than in corneas of healthy individuals [5]. The present study was undertaken to compare the CCT in patients with normal tension glaucoma with that of primary open angle glaucoma, ocular hypertension and normal subjects and its effect on the clinical management of patients of glaucoma

The aims of the study are to compare the CCT values of NTG, POAG, OHT patients with controls and to determine the effect of CCT on diagnosis and management of glaucoma patients.

Materials and Methods

The study was a prospective study conducted in the department of Ophthalmology at a tertiary care centre in South India. Ethical committee clearance was obtained from the study. A written informed consent was obtained from all the participants. The study was conducted from January 2017 to August 2017. A total of 99 patients diagnosed with glaucoma attending the Ophthalmology OPD were included in the study. The patients were grouped as Normal tension glaucoma, Primary open angle glaucoma, Ocular hypertension. Patients with IOP of 21 mm Hg or lower at initial visit, open, normal angles, glaucomatous optic disc and glaucomatous visual field defects were diagnosed as NTG, patients with IOP greater than 21mm Hg, open, normal angles, glaucomatous optic disc and glaucomatous visual field defects were labelled as POAG, patients with IOP greater than 21 mm Hg, open, normal angles, normal optic disc, normal visual fields were diagnosed as ocular hypertensives. Age and gender matched controls were selected from otherpatients attending the OPD. Eyes with corneal pathology, Eyes with previous intra ocular, eyes with Secondary Glaucoma were excluded from the study. Detailed ophthalmic and systemic history was obtained from all the patients. All patients underwent a thorough ophthalmic examination including visual acuity, Slit lamp biomicroscopy of anterior segment. Intraocular pressure was recorded using Goldmann Applanation Tonometry (GAT). Multiple measurements were taken during office hours to rule out diurnal variations in NTG patients. Patient cornea was anaesthetized with 4% xylocaine and stained with fluorescein strips. Necessary adjustments were made so that flattened area with 2 semi circles of equal size are seen in the middle of view. The pressure on the eye is then increased by turning the measuring drum until the inner borders of the 2 fluorescein rings just touch each other. Reading on the measuring drum is multiplied by 10 to get IOP in mmHg. 3 readings were taken and average calculated. Gonioscopy was done using goldmann three mirror contact to know the status of the angle. The pupils were dilated using tropicamide eye drops and the optic nerve head was examined using 90D magnifying lens. Detailed drawings of ONH was done that included area of cupping and pallor in all quadrants, position of kinking of vessels, splinter hemorrhages, peripapillary changes. Indirect ophthalmoscopy was done to look for any peripheral retinal pathology. Visual fields were assessed using Humphrey visual field analyser.Central corneal thickness was measured using ultrasonic pachymeter on the next follow up visit. After applying a drop of 4% xylocaine for local anaesthesia, the pachymeter tip was placed perpendicularly on the cornea and centered over an undilated pupil and readings were taken when pachymeter gives beep. From each eye 3 readings were taken and average is calculated. The measured IOP were corrected using linear correction formula. Ehlers and Hansen calculated an error evoked by a thinner or thicker cornea to be 0.7mm Hg per 10µ deviation from the normal value of 520µ.

In our study we used the same linear correction scale of 2.5 mmHg addition or subtraction for every 50 µ deviation as done in Doughty and Zaman Meta analysis study (4).

$$\text{Corrected IOP} = \text{Measured IOP} - \frac{(\text{CCT} - \text{Reference CCT}) * 2.5}{50}$$

The population based Baltimore Eye [6] survey observed 50% and Early manifest Glaucoma Trial (7) 30% reduction in the risk for every 3.0mm Hg

decrease in the initial IOP. Leske MC et al. in Early manifest Glaucoma Trial reported 'each higher (or lower) millimeter of mercury of IOP on follow-up was associated with an approximate 10% increased (or decreased) risk of progression. In our study, we opted the cutoff value used in a study done by Shih CY et al. [4] and modification in the glaucoma treatment plan was then noted for patients with measurement and outcomes significant IOP adjustments. The changes in therapy included addition or discontinuation of antiglaucoma medications and recommendation or deferment of glaucoma inscisional surgery.

Results

A total of 99 patients were included in the study. Out of 99 patients in the study, 64 (64.65%) were males and 35 were (35.35%) females and the difference was not statistically significant (p>0.05). The patients were divided into four groups- 28 patients (21 males, 7 females) of POAG, 22 patients (11 males, 11 females) of NTG, 12 patients of OHT (8 males, 4 females), 37 controls (males 24,females 13). All the subjects were studied in terms of age, IOP, CCT, corrected IOP. Although the observations were made in both eyes of all the subjects, the right eye of each subject was included for statistical analysis.

The mean age of females in the study was 55.80±6.45 years with a range from 40 years to 70 years. The mean age of males was 56.38±8.58 years ranging from 40 years to79 years. There was no statistically significant difference in mean age among males and females (p > 0.05).

The mean age of NTG patients was 57.45±8.51 years ranging from 40 years to79 years, POAG patients was 57.50±7.45 years ranging from 45 years to79 years, OHT patients was 50.58±4.25 years ranging from 44 years to58 years. The difference observed in mean age among the different groups was not statistically significant. (p > 0.05).

The mean IOP value in the study population was 21.36±7.50 mm Hg in right eye and 19.56± 5.47 mm Hg in left eye. The RE Mean IOP in the right eye among males was 22.297±5.45 mm Hg ranging from 12 to 40 mm Hg and among females the mean IOP was 19.657±4.53 mm Hg ranging from 12 to 28 mm Hg. There was no statistically significant difference in mean IOP values between males and females (p>0.05). The mean IOP values in the left eye among males was 20.063±5.45 mm Hg ranging from 12 to 54 mm Hg and among females the mean IOP was 18.914±5.49 mm Hg ranging from 20 to 30 mm Hg. There was no statistically significant difference observed in mean IOP values between male and females (p>0.05). The mean IOP clinically was lower in females compared to males but was not statistically significant.

The mean IOP in patients of normal tension glaucoma was 16.70±1.90 mm Hg ranging from 12 to 20 mm Hg, in patients of POAG was 29.61± 8.55 mm Hg ranging from 16 to 54 mm Hg, patients of OHT was 24.5±1.51 mm Hg ranging from 16 to 54 mm Hg. There was a statistically significant difference in the mean IOP values among the three groups. The further subgroup comparison of mean IOP between the groups revealed that the NTG patients had statistically significant lower IOP than POAG and OHT patients (p<0.05). The OHT patients had statistically significant higher IOP than NTG patients and statistically significant lower IOP than POAG patients. (Table 1).

Table 1: Mean IOP in study groups

Study groups	n	Mean	SD	Min	Max	F value	p value
Normal	37	16.70	1.90	12	20	45.26	<.0001
NTG	22	17.00	2.60	12	20		
POAG	28	29.61	8.55	16	54		
OHT	12	24.5	1.51	22	26		

The mean CCT of the study population was 527.13±28.09 microns ranging from 481 to 610 microns in the right eye and 528.02±27.85 microns ranging from 480 to 610 microns in the left eye. The mean CCT in the RE among males was 530.09±29.193 microns ranging from 481 to 610 microns and among females the mean CCT was 521.71±29.193 microns ranging from 482 to 602 microns. There was no statistically significant difference in the mean CCT between males and females (p > 0.05). The mean CCT in the left eye among males was 531.02±28.664 microns ranging from 485 to 610 microns and in females the mean CCT was 522.71±25.91 microns ranging from 480 to 600 microns. The difference observed in mean CCT between males and females was not statistically significant (p > 0.05). Even though the mean CCT was not statistically significant between the males and females with respect to left and right eyes, CCT in females was lower than the males (Table 2 & 3).

Table 2: Mean CCT of the Entire study sample

Sex (n)	RE CCT (µ)				LE CCT (µ)			
	Mean	SD	Min	Max	Mean	SD	Min	Max
Female (35)	521.71	25.463	482	602	522.71	25.91	480	600
Male (64)	530.09	29.193	481	610	531.02	28.664	485	610
Total (99)	527.13	28.09	481	610	528.02	27.85	480	610
't' value	-1.43				-1.42			
'p' value	0.1569				0.1597			

Table 3: Mean Central Corneal Thickness (CCT) according to age group

		Right eye-CCT				Left eye-CCT			
Age Group	N	Mean	SD	Min	Max	Mean	SD	Min	Max
40-49	16	544.69	35.99	482.0	595.0	544.13	36.04	480.0	595.00
50-59	55	526.42	26.30	482.0	610.0	527.76	25.83	485.0	610.00
60-69	19	520.11	24.34	483.0	558.0	520.06	25.16	480.0	563.00
>=70	9	515.11	18.28	481.0	538.0	516.89	17.52	485.0	540.00
'F' value		3.25							
'p' value		0.0252							

The mean CCT in right eye in 40-49 year group was 544.69 microns, 50-59 age group was 526.42 microns, 60- 69 age group was 520.11 microns and greater than 70 age group was 515.11 microns suggesting that mean CCT decreased with advancing age. Although the CCT decreased clinically with increasing age, there was no statistically significant difference in the CCT between different age groups.

The mean CCT of controls was 527.65±21.90 microns ranging from 481 to 562 microns and 528.76±22.42 microns ranging from 480 to 565 microns in right and left eye respectively. The mean CCT of NTG was 503.91±11.31 microns ranging from 482 to 521 microns and 504.36±11.07 microns ranging from 480.0 to 523.0 microns in right and left eye respectively. The mean CCT of POAG patients was 525.25±23.59 microns ranging from 482 to 590 microns and 526.38±21.98 microns ranging from 485.0 to 590.0 microns in right and left eye respectively. The mean CCT of OHT was 572.25± 22.71 microns ranging from 540 to 610 microns and 572.67±22.20 microns ranging from 540 to 610 microns in right and left eye respectively. There was a statistically significant difference in mean CCT among the groups. ($p < 0.05$).

The further analysis of comparison of mean CCT between the groups revealed that CCT in NTG patients was statistically significantly lower than the controls, POAG and OHT. The central corneal thickness in OHT patients was statistically significantly higher than the controls, POAG and NTG whereas no difference was found between POAG and controls IOP was corrected after measuring CCT. It was observed 32.258% of total glaucoma patients had significant changes after correcting for CCT. 27.3% (6 out of 22) in NTG, 66.7 % (8 out of 12) in OHT and 21.4% (6 out of 28) in POAG group had measurement significant change. The difference observed was statistically significant ($p<0.05$).

Discussion

Our study shows no significant difference in age between NTG and POAG similar to that found in Morad Y study group [8]. OHT patients were significantly younger than POAG, NTG similar to that found in Copt RP group. No significant difference in NTG, POAG and Controls found in our study.

Copt RP et al in their study found no significant difference in CCT between controls (552±35 microns) and patients with POAG (543±35 microns), but the CCT in the group with NTG (521±31 microns) was significantly lower than that in the control group or the group with POAG ($p < .001$), and the CCT in the group with OHT (583±34 microns) was significantly higher than in controls or patients with POAG ($p < .001$) and concluded that underestimation of the IOP in patients with POAG who have thin corneas may lead to a misdiagnosis of NTG, while overestimation of the IOP in normal subjects who have thick corneas may lead to a misdiagnosis of OHT [5].

Thomas R and associates in their study of effect of CCT on applanationreported that there was a statistically significant difference in the mean CCT of the ocular hypertensives (0.574±0.033 mm) as compared to the glaucoma (0.534±0.030 mm) and

normals (0.537±0.034 mm).Measurement of central corneal thickness is advisable when the clinical findings do not correlate with the applanation IOP [9].

Ventura AC, Bohnke M, Mojon DS measured CCT in NTG, POAG, OHT and Pseudoexfoliatives using optical low coherence reflectometry which is more precise method than ultrasound pachymeter. The study confirms that a significant number of patients with OHT have normal IOP after appropriate adjustments [10].

Mean IOP in study groups ranged from 13.06 to 27.13 mm Hg. Mean IOP of NTG and controls is significantly lower than POAG and OHT patients. No significant difference is seen between NTG and controls. OHT patient's mean IOP is lesser than POAG where as in other studies POAG patient' is lower than OHT.

In our study, CCT of NTG patients is significantly lower than POAG and controls as has been found in Morad Y et al., Emara BY et al., Copt RP et al and Dave et al. studies while OHT patients had significantly higher central corneal thickness than controls.

Emara BY and associates studied CCT in NTG patients and found significantly lower CCT in NTG compared to POAG leading to underestimation of IOP. Corneal thickness should be taken into account when managing these patients to avoid under treatment [11].

Shah S, Chatterji A, Mathai M et al. found corneal thickness as a confounding factor in classification of glaucoma patients and reported that patients with thick corneas and high IOP's may not be followed as Glaucoma suspects [12].

Shah S, Spedding C et al assessed the diurnal variations in CCT of Glaucoma suspects and found no significant variation in CCT and concluded that a single measurement of CCT is sufficient when assessing patients with suspected glaucoma [13].

Singh RP and associates measured a CCT of 538±51 in NTG, 570±32 in OHT, 547±34 in POAG and 554±32 in normals showing a significant difference and when CCT is markedly different from normal, the clinician may need to factor this into diagnosis and management [14].

Chen HC and associates studied CCT in normal tension glaucoma and non-glaucoma patients and observed a mean (±SD) central corneal thickness in the healthy subjects and NTG patients was 554.1 (±36.3) and 547.2 (±31.4) microns, respectively with no significant differences of central corneal thickness between NTG patients and healthy subjects in their clinic [15].

POAG and NTG patients similar to that found in Emara Y, Dave et al. No significant difference in CCT is found between controls and POAG patients similar to that found Morad et al, Shah S et al., Wu L et al. [16], and Dave et al. 6 (27.27%) NTG patients showed measurement significant changes with no NTG patients showed outcomes significant changes. 6 (21.43%) POAG patients showed a measurement significant changes with 1 (3.57%) patient showing outcome significant changes. 8 (66.67%) OHT patients showed measurement significant changes with 3 (25.0%) patients showing outcome significant changes. In our study maximum changes are seen in OHT patients followed by NTG and POAG patients.

Early Manifest Glaucoma Trial has concluded that each higher (lower) mmHg of IOP on follow up is associated with an approximately 10% increased (or decreased) risk of progression. Considering that in our study, 8.06% of glaucoma patients have been recommended change in the medical therapy and 3.22% have been asked to discontinue their medication, 1.61% were advised surgery. In Shih et al study 8.5% had a change in medication, 2.1% had deferment or addition of laser and 3.2% had a change in whether they would receive glaucoma surgery. Limitation of the study is that no long term follow up is done to support the clinical implications of these changes made in their management based on CCT corrected IOP.

Reclassification of Glaucoma patients was done after correction of measured IOP for CCT. 5 (22.7%) of NTG patients were reclassified as POAG patients and 3 (25%) of OHT patients were reclassified as Normal. Nearly one fourth of NTG and OHT were misdiagnosed where as in a study by Copt RP et al., 31% of NTG was reclassified as POAG and 56% of OHT as normal.

Conclusion

This study confirms that central corneal thickness is significantly lower in normal tension glaucoma patients compared to controls and primary open angle glaucoma patients whereas ocular hypertension patients have significantly higher central corneal thickness than controls and primary open angle glaucoma patients. No significant difference is found between primary open angle patients and controls.

Due to the effect of CCT on measurement of

IOP with applanation tonometer, which is the main parameter in the diagnosis and follow up of glaucoma patients, many POAG patients are misdiagnosed as NTG patients and normals are misdiagnosed as OHT patients and improperly managed. Measurement of central corneal thickness aid the ophthalmologist in correct diagnosis and better management of glaucoma and glaucoma suspects especially when their corneal thickness differs markedly from normal.

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Influence of Diabetes on Cataract: A Study in A Tertiary Care Centre

Rasna Sharma

Abstract

Introduction: A cataract is opacity of the lens that interferes with vision, and is the most frequent cause of visual impairment. It is always important it identify the risk factors that affect the development and progression of cataract. We have attempted in our study to identify the risk factors and grade of cataract associated with diabetes. *Materials and Methods:* Demographic details, physical and clinical evaluation was done for 245 patients. Blood pressure was taken and HdA1c levels was measured for all patients with elevated blood sugar levels. The nature of the cataract was categorized such as immature senile cataracts–partially opaque lens and the disc view hazy (IMSC), mature senile cataracts–completely opaque lens with no disc view (MSC) and hyper mature senile cataracts-liquefied cortical matter (HMSC). *Results:* 72.7% of these patients had diabetes while 66.9% of them had hypertension. The prevalence of cataract was more in patients with diabetes and hypertension rather than those with these risk factors alone. In the patients who had diabetes for less than 5 years, 86.4% of the patients had Immature senile cataracts with partially opaque lens and hazy disc view (IMSC) and 8.8% patients had hyper mature senile cataract with liquefied cortical matter (HMSC). In patients who had diabetes for more than 15 years, 98.1% had IMSC and there were no patients with HMSC. *Conclusion:* Although diabetes has no influence on the age and the grade of the cataract, there was a considerable association between diabetes and cataract.

Keywords: Cataract; Diabetes; Visual Impairment.

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Introduction

A cataract is opacity of the lens that interferes with vision, and is the most frequent cause of visual impairment worldwide, especially for the elderly because the incidence of cataracts increases with increasing age. It is the leading cause of blindness affecting around 42% of overall visual impairment. In India, it is estimated to cause almost 80% blindness [1].

This multifactoral disease process is induced by various toxic factors, environmental, stressors and gene mutations. Cataract is classified into four types, nuclear, cortical, posterior subcapsular and mixed. Cataract is known to be associated with damage or death of lens epithelial cells [2].

It is always important it identify the risk factors that affect the development and progression of cataract. A number of risk factors are known to be associated with cataract like diabetes, hypertension, obesity, age, race, smoking alcohol use and low socioeconomic status [3,4]. Identification of the factors that could delay or prevent cataract development would be important both for increasing the well being of an older patient as well as reduction of the health care costs [5].

Diabetes is one of the most common health hazard of today globally. It has been estimated by the International Diabetic federation that in 2015, 415 million people were living with diabetes and it is estimated to rise to 642 million people by the year 2040 [6].

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Diabetes is a well-recognized cause of premature death and disability, increasing the risk of cardiovascular disease, kidney failure, blindness and lower-limb amputation [7]. Hyperglycemia, blood pressure and elevated blood lipid levels seem to be one of the major cause of diabetic complications and disease progression [8,9]. Ocular complications are one of the frequent complication to both Type 1 and Type 2 diabetes and is considered to be the fifth most common cause of blindness. In 95% of type 1 diabetic and 60% of type 2 diabetics with disease duration longer than 20 years, signs of diabetic retinopathy occur [10-12].

Visual impairment is another global problem which is estimated to be prevalent in 45 million people being blind and 135 million having severe visual impairment. It is found to be more prevalent among the developing countries such as Africa, Asia and Latin America rather than the developed with the incidence being 10-40 times higher [13].

We have attempted in our study to identify the risk factors and grade of cataract associated with diabetes. This would help the ophthalmologist to predict the development of cataract in a diabetic patient and plan an effective surgical intervention.

Materials and Methods

This study was conducted by the Department of Ophthalmology at Mallareddy Medical college for Women during a period of of 2 years 4 months ie from June 2015 to Sep 2017. 245 patients with cataract, above the age of 40 years were included into the study. Patients who had other ocular disorders like corneal disorder, glaucoma, vitreous disorders and other lens abnormalities were excluded from the study.

Demographic details were taken from all the patients after the informed consent was acquired. All of them underwent complete physical and clinical examination. Blood tests were done for all the regular biochemical and hematological parameters including random blood sugar to identify the sugar levels. Those who were found to have elevated blood sugar levels underwent HbA1c level detection. The duration of diabetes, medication for diabetes was also noted.

Ophthalmological evaluation was done and the best corrected visual acuity assessment, anterior segment evaluation using slit lamp biomicroscopy and dilated fundus examination using 90 D lens and indirect ophthalmoscopy.

The nature of the cataract was categorized such as immature senile cataracts–partially opaque lens and the disc view hazy (IMSC), mature senile cataracts–completely opaque lens with no disc view (MSC) and hyper mature senile cataracts-liquefied cortical matter (HMSC).

Results

The average age of the patients was 61.6 years with males being the predominant gender affected with cataract. Most of these patients (72.7%) had diabetes while 66.9% of them had hypertension (Table 1).

Table 1: Baseline characteristics of patients

Parameter	N (%) or mean (SD)	95% CI
Age (in years)	61.6±6.9	59.3–62.7
Sex (male)	142 (58%)	55.5-60.0
Smoker	43 (17.6%)	15.5-19.6
Hypertension	164 (66.9%)	62.9-68.2
Diabetes	178 (72.7%)	71.0-73.5
BMI	25.8±3.9	25.1-26.3

The average age was higher in the cataract patients with no cataract or hypertension (66.3 years), while those having both were faster to achieve cataract (58.7 years). The same was the case with sugar levels and the systolic and diastolic blood pressure, which were all higher in patients with both the risk factors (Table 2).

Table 2: Age, pressure and blood sugar levels in normal, diabetic, and hypertensive patients

	Normal	Hypertensive	Diabetics	Hypertensive with diabetes
Age (in years)	66.3±3.2	61.4±4.1	60.9±2.9	58.7±3.6
Systolic (mmHg)	127.8±1.1	158.5±1.4	126.9±0.98	161.8±3.1
Diastolic (mmHg)	84.3±0.7	116.5±3.4	81.3±0.9	119.3±2.4
Fasting Blood Sugar	88.3±4.1	89.1±2.8	141.5±2.4	144.3±4.1

In the patients who had diabetes for less than 5 years, 86.4% of the patients had Immature senile cataracts with partially opaque lens and hazy disc view (IMSC) and 8.8% patients had hyper mature senile cataract with liquefied cortical matter (HMSC). In patients who had diabetes for more than 15 years, 98.1% had IMSC and there were no patients with HMSC (Fig: 1).

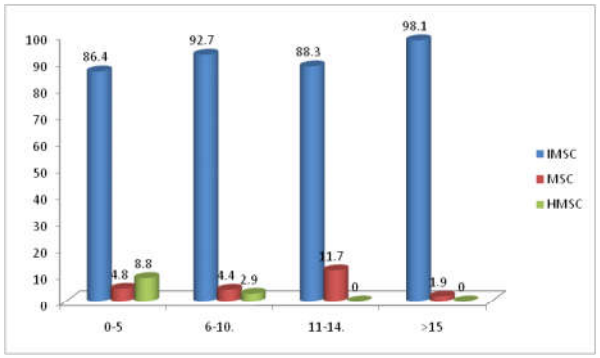

Fig. 1: Association of type of cataract with duration of diabetes

Discussion

Cataract is a major cause of vision impairment in people with diabetes. Numerous studies have documented an association between diabetes and cataracts [14-16]. Klein et al. demonstrated that patients with diabetes mellitus are 2–5 times more likely to develop cataracts than their nondiabetic counterparts [15]. Data from the Framingham and other eye studies indicate a three to fourfold increased prevalence of cataract in patients with diabetes under the age of 65, and up to a twofold excess prevalence in patients above 65 [17,18].

The pathogenesis of cataract in the diabetic patients has been attributed to the large amounts of glucose present in the blood wherein hexokinase becomes saturated and the excess glucose enters the polyol pathway when aldose reductase (AR) reduces it to sorbitol. Intracellular accumulation of sorbitol leads to osmotic changes resulting in hydropic lens fibers that degenerate, ultimately results in the formation of lens opacities (form sugar cataracts). The speed of conversion sorbitol is faster than it is converting to fructose by the enzyme sorbitol dehydrogenase. The intracellular increase of fluid in response to AR-mediated accumulation of polyols results in lens swelling associated with complex biochemical changes ultimately leading to cataract formation [19-21].

Duration of diabetes is also considered to be a risk factor for the incidence of cataract [22]. In our study, though, we found no relation between age and the grade of cataract. Similar results were found in a study by Lathika et al, where in there was no association of grade of cataract to age [23].

However, we have found a considerable association to occur between cataract and diabetes. The advancing age in combination with diabetes and hypertension were largely associated with cataract. In fact age related cataract has been estimated ot be the cause of blindness in 17 million individuals [24].

In our study we also found less occurrence of cataract in individuals with normal blood pressure along with normal blood sugar levels, showing that hypertension also has a significant influence on cataract. Similar results were observed in a similar study by Shakil et al. Few other studies also have associated high blood pressure to be the cause of higher incidence of cataract [4,25-28].

In a Barbados Eye study, the 4 – year lens opacities were evaluated and the factors which increased the risk for cortical opacity was old age, female gender, low economic status and diabetes mellitus. The risk factors for posterior subcapsular opacity were age, and diabetes ad for nuclear opacity, it was age, leaner body mass and diabetes [29,30].

Conclusion

Although diabetes has no influence on the age and the grade of the cataract, there was a considerable association between diabetes and cataract. Moreover, diabetes along with hypertension was a likely to lead to cataract and eventually blindness.

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Study of Outcome of Cataract Surgery in Diabetic and Non-Diabetic Patients

Sharanabasamma M.[1], Prasanth K.[2]

Abstract

Aims & Objectives: To evaluate the postoperative visual acuity and complications in diabetics and non-diabetics with cataract surgery

Method: A prospective case study of 100 eyes group A 50 eyes of diabetic and group B 50 eyes of non–diabetic all cases were operated by single surgeon. Patients underwent minimal incision cataract surgery SICS with PCIOL. Age group was taken 30 to 60years and above with good glycaemic control, surgical technique, and preoperatively and postoperative follow up day 1, POD 1week , 6weeks respectively, complication and ocular evaluation done with visual acuity (BCVA).

Results: Total 100 eyes 50 diabetic and 50 non-diabetics 41 males and 59 females. The mean age group in diabetic was 57.66 ± 8.29 years and 57 ± 7.27 years in non-diabetic group. All cases underwent SICS with PCIOL. Mean pre-operative visual acuity in the diabetic patients group A was 1.28 + 0.42 and non-diabetic patients group B was 1.37 +0.59. Mean post-operative best corrected visual acuity in log MAR units in the diabetic group A was 0.30 + 0.4 and in the group, B was 0.28 +0.5. The difference in pre and post op visual outcome was statistically not significant ($p=0.01$). Post-operative visual acuity of 6/9 or better was achieved in 36 (72%) eyes in diabetics and 40 (80%) among non-diabetics. Post-operative complications like Wound malposition, corneal oedema, striate keratopathy, anterior chamber reaction, pigment dispersion, cystoids macular edema and posterior capsular opacification. This incidence was higher in the diabetics ($p<0.01$).

Conclusion: Patients with no diabetic retinopathy or maculopathy do not require any special management if cataract surgery was uncomplicated. Visual acuity is similar in both groups. Post-operative complications like corneal oedema and anterior chamber reaction are more common in diabetics.

Keywords: Diabetic; Non-Diabetic; Cataract Surgery; Diabetic Cataract; Diabetes Mellitus.

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Introduction

Diabetes mellitus is a risk factor for development of cataract [1]. Development of cataract is the second most ocular common complication of diabetic mellitus [2]. Population growth, ageing, urbanization, sedentary lifestyles and an increasing prevalence of obesity are increasing the number of people with diabetes mellitus. Worldwide more than 285 million people are affected by diabetes mellitus. This number is expected to increase to 439 million by 2030 according to the International Diabetes Federation. Globally, cataracts remain the leading cause of blindness, affecting approximately 18 million people. Cataracts occur at an early age and 2-5 times more frequently in patients with diabetes, thus visual loss has a significant impact on the working population. Overall, upto 20% of all cataract procedures are estimated to be performed for diabetic patients [3]. Patients with diabetes

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mellitus have higher complication rates from cataract surgery. Furthermore some studies have reported that cataract surgery may have adverse effects, including, progression of retinopathy, vitreous haemorrhage, iris neovascularisation and decrease or loss of vision. Both diabetes and cataract pose an enormous health and economic burden, particularly in developing countries, where diabetes treatment is insufficient and cataract surgery often inaccessible [4].

Materials and Methods

This is a prospective study conducted between November 2016-May 2017 at Navodaya Medical College and Hospital. During this period, Total 100 patients underwent cataract surgery 50 diabetics and 50 non-diabetics who underwent Small Incision Cataract Surgery with Posterior Chamber Intraocular lens Implantation. The Patients included Age group 30-60 years and above with type 2 diabetes mellitus patients with good glycaemic control prior to surgery who have given informed consent were examined prospectively, Preoperative examination of visual acuity by Snellen's chart , measuring of Intraocular pressure (IOP) by Applanation tonometry, Anterior segment Slit lamp Examination, Gonioscopy (examination of the anterior chamber angle) and Posterior segment evaluation by Indirect Ophthalmoscope, In order to exclude, Patients with traumatic, uveitis or complicated cataract, glaucoma, Neovascularisation of iris, Iridocyclitis, Uncontrolled diabetes, Posterior segment diseases like pre-existing maculopathy and retinopathy . All these patients underwent pre-operative evaluation and complete ophthalmic examination, including a thorough history with required demographic data. Systemic evaluation was also carried out.

Pre-operative preparation: A day before prior to surgery one drop of moxifloxacin eye drops was given at hourly intervals. Pupillary dilatation by using tropicamide and phenylephrine 0.5% eye drop one hour before surgery. All patients underwent small incision cataract surgery with posterior chamber intraocular lens implantation under peribulbar anaesthesia.

Post-operative evaluation: On post-operative day 1, Visual acuity was recorded to all the patients and with detailed slit lamp examination and fundus examination. Patients were discharged on the second post-operative day. Advised On discharge all patients should receive same brand of ofloxocin dexamethasone combination eye drops 6-8 times per day, which was then tapered over a period of 6 weeks. The patients were asked to review at 1 week, 6 weeks and 3 months from the date of surgery. Fallow ups were subjected to examine; Slit lamp examination assessment of anterior chamber inflammation aqueous flare and cells measured by counting within the field visible with a slit lamp keeping the beam at maximum intensity. Fundus examination, Visual acuity was recorded on every visit.

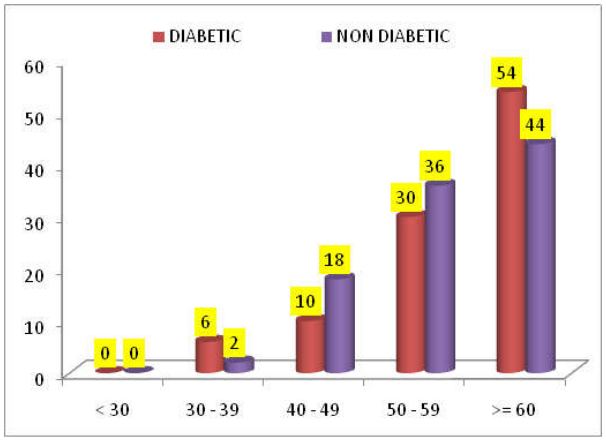
Results

In the prospective study 100 patients were divided into two group and examined. Group A 50 eyes of diabetics group A and 50 eyes of non-diabetics in group B underwent small incision cataract surgery with intraocular lens implantation. The age and sex wise distribution, glycaemic control, preoperative visual acuity, complications of the procedure and final visual outcome were analyzed.

In this study, highest number of patients were in the Age group of 60 years and above 49 (49%) in group A 27 (54%) in group B. 22 (44%). Remaining 23 (46%) of the patients in diabetics and 28 (56%) of the patients in non-diabetic group B were below 60 years (Table 1 and Graph 1).

Table 1: Age distrbution

Age (Years)	Diabetic		Non Diabetic		Total	
	No	%	No	%	No	%
< 30	0	0	0	0	0	0
30 – 39	3	6	1	2	4	4
40 – 49	5	10	9	18	14	14
50 – 59	15	30	18	36	33	33
>= 60	27	54	22	44	49	49
Total	50	100	50	100	100	100
Mean ± SD	57.66 ± 8.29		57.18 ± 7.27		57.42 ± 7.764	

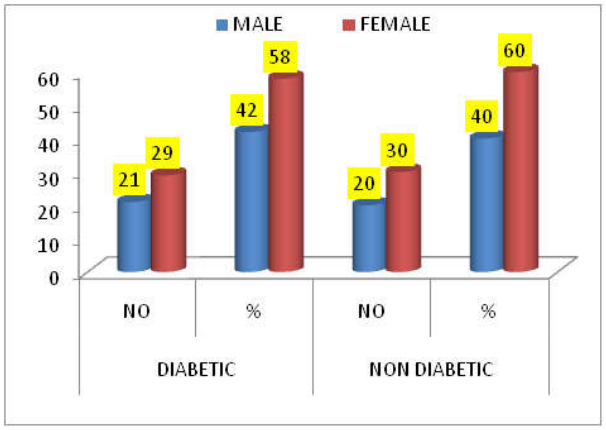


Graph 1:

In this study gender distribution, in group A 29 (58%) were females and 21 (42%) were males. Among group B, 28 (56%) were Females & 22 (44%) were males (Table 2 and Graph 2).

Table 2: Gender distribution

Sex	Diabetic		Non Diabetic		Total	
	No	%	No	%	No	%
Male	21	42	22	44	41	41
Female	29	58	28	56	59	59
Total	50	100	50	100	100	100



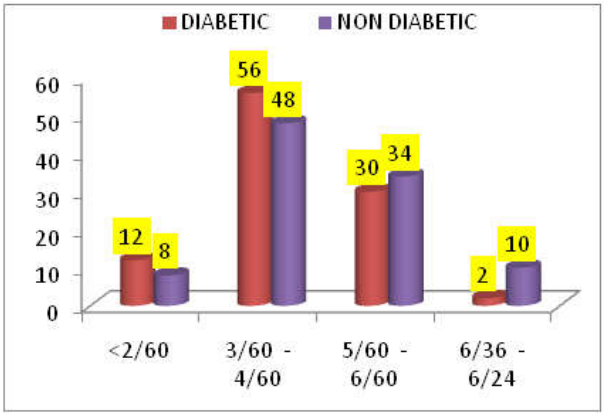
Graph 2:

In group A diabetic patients 34 (68%) had good glycemic control prior to surgery (RBS: 79–160 mg/dl). 1 (2%) patients had low blood sugar levels at the time of examination (<79 mg/dl). Their blood sugars normalized eventually and they were operated. More importantly, 15 (30%) patients had high fasting blood sugar levels (RBS: >160 mg/dl). The height fasting blood glucose value recorded was 120 mg/dl. This included patients with and without treatment.

In this study, 44 (88%) of the patients were type 2 diabetes mellitus on either injection insulin or oral hypo-glycaemic agents while the remaining 6 (12%) of patients without any treatment. 28 eyes (56%) of the diabetics and 24 eyes (48%) of the non-diabetics patients had vision acuity 3/60 to 4/60. Among all patients were more in 49 (98%) of the diabetics and 45 {90%) of the non-diabetics had visual acuity less than 6/60. 1 (2%) of the group A and 5 (10%) of the group B had vision of 6/36 - 6/24. The mean preoperative BCVA in the diabetic group was 1.28 ±0.42 and ingroup B was 1.37 ± 0.59. The p value (<0.10) was not statistically significant. (Table 3 and Graph 3).

Table 3: Preoperative visual acutiy

Visual Acuity	Diabetic		Non Diabetic		Total	
	No	%	No	%	No	%
<2/60	6	12	4	8	10	10
3/60 - 4/60	28	56	24	48	52	52
5/60 - 6/60	15	30	17	34	32	32
6/36 - 6/24	1	2	5	10	6	6
Total	50	100	50	100	100	100

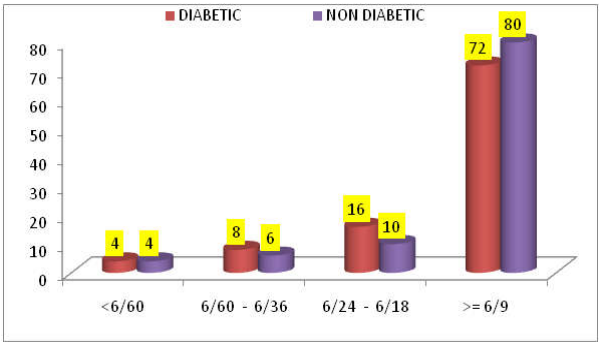


Graph 3:

the final visual outcome was recorded using Snellen's visual acuity chart. Majority of the patient's Visual acuity of 6/9 or better at the end of 6 weeks of follow up. Only 2 patients in the diabetic group and 2 patients in the non-diabetic group had visual acuity less than 6/60. The mean post-operative best corrected visual acuity in log MAR units in the diabetic group A was 0.30 + 0.4 and in the group B was 0.28 + 0.5. On comparing the post op values in both the groups the p value was (<0.2) which was not statistically significant. On comparing the pre-operative and post-operative visual acuity in both the groups the p value (0.01) was statistically significant (Table 4 and Graph 4).

Table 4: Post operative visual acuity

Visual Acuity	Diabetic		Non Diabetic		Total	
	No	%	No	%	No	%
<6/60	2	4	2	4	4	4
6/60 - 6/36	4	8	3	6	7	7
6/24 - 6/12	8	16	5	10	13	13
>= 6/9	36	72	40	80	76	76
Total	50	100	50	100	100	100



Graph 4:

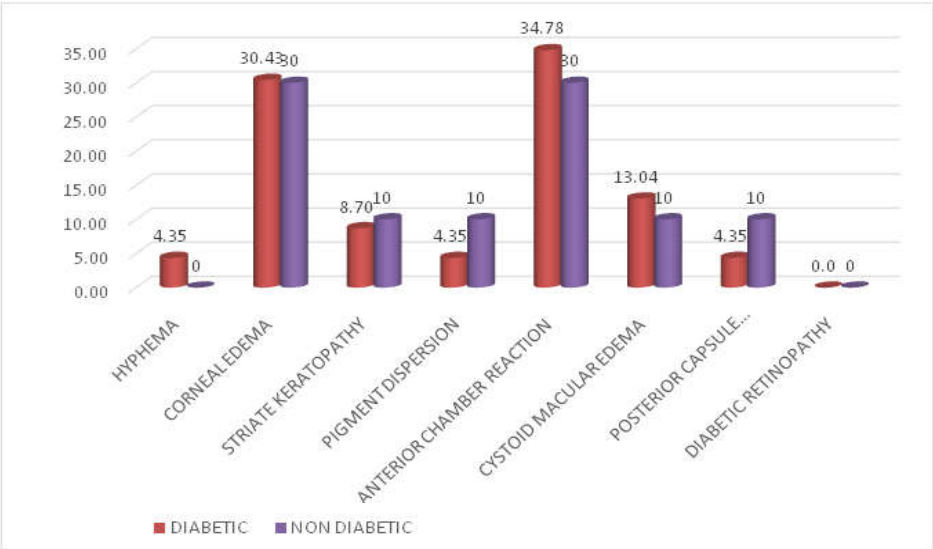
Post-operative complications were noted development of PCO was in diabetics 1 (4.35%) and 1 eye (10%) in non-diabetics after 6 weeks fallow up. Cystoid macular edema was noted in 3 (13.04%) of diabetic and 1 (10%) of non-diabetic eyes post operatively at the end of 6 weeks. Hyphema seen in 1 (4.35%) in diabetic group.Corneal oedema 7 (30.43%) and 3 (30%) of the cases in diabetic and non-diabetic groups respectively which was considerably higher in diabetics compared to non-diabetics. Striate keratopathy was found in 2(8.70%) of the diabetics compared to 1 (10%) in non-diabetics. Pigments Dispersion were seen in 1 (4.35%) of the cases in diabetics as compared to 1 (10%) in the group B. It was similar in both the groups in our study (Table 5 and Graph 5).

Discussion

This study, highest number of patients were in the age group of 60 years and above that is 27 (56%) in diabetics & 22 (44%) in control group. Remaining 23 (46%) of the patients in diabetics and 28 (56%) of the patients in non-diabetic group B were below 60 years. The mean age group of the patients in diabetic group was 57.66 ± 8.29 and 57.18 ± 7.26 years in non-diabetic group.

Table 5: Postoperative complications

Complications	Diabetic		Non Diabetic		Total	
	No	%	No	%	No	%
Hyphema	1	4.35	0	0	1	3.03
Corneal Edema	7	30.43	3	30	10	30.30
Striate Keratopathy	2	8.70	1	10	3	9.09
Pigment Dispersion	1	4.35	1	10	2	6.06
Anterior Chamber Reaction	8	34.78	3	30	11	33.33
Cystoid Macular Edema	3	13.04	1	10	4	12.12
Posterior Capsule Opacification	1	4.35	1	10	2	6.06
Diabetic Retinopathy	0	0.0	0	0	0	0
Total	23	100	10	100	33	100



Graph 5:

The Framingham and other eye studies indicate a 3-4 fold increased prevalence of cataract in patients with diabetes under 65 [5,6]. In this study, in diabetic group 29 (58%) were females and 21 (42%) were males. Among the non-diabetic 22 (44%) males & 28 (56%) were females.

In the Framingham eye study also senile lens changes were more common in women. In our study majority of patients were also females. In these 50 patients in group A, we assessed the pre-operative 15 (30%) patients had high Random blood sugar levels (RBS > 160 mg/dl). Under control of glycaemic levels and they were operated. In the present study, 44 (88%) patients on treatment for type 2 diabetes mellitus on either injection insulin or oral hypo-glycaemic agents, 6 (12%) without treatment. Nascimento et al. reported that serum glucose level had no influence on the peri-operative clinical complications and final visual outcome of cataract surgery amongst diabetic patients [7]. Rapid pre-operative glycemic control should be avoided as it may increase the risk of post-operative progression of retinopathy and maculopathy [8]. The risk for cataract formation and diabetic retinopathy is increased in patients with longer duration of diabetes and in those with poor metabolic control. The prevalence of cataract was higher in those with a longer duration of diabetes and known diabetes, suggesting a more prolonged influence of biochemical cataractogenic stimuli (hyperglycemia) The other systemic co-morbidities in our study was not statistically significant. Patients underwent SICS with PCIOL implantation, and all the Surgeries were done by the single surgeon. On evaluation of patients on post-operative day 1 in diabetic group corneal oedema was noted 7 (30.43%) and 3 (30%) and non-diabetic groups. which was higher in diabetics compared to non-diabetics. Hyphema was noted in 1 (4.35%) in diabetic group. Striate keratopathy was noted in 2 (8.70%) of the diabetics 1 (10%) in nondiabetics. Other studies showing similar higher percentage of striate keratopathy are: Onakpoya H Oluwatoyin et al. [9] 30% in diabetic compared to 13% in control group. Larsson et al. [10] have shown that diabetes has been associated with structural changes in corneal endothelial cells such as polymegathism and pleomorphism. The cornea has been reported to be thicker in eyes of diabetic patients than in eyes of non-diabetic subjects. Cataract extraction and IOL implantation causes trauma to the already compromised corneal endothelium and causes corneal edema. Lee JS et al. [11] showed a decrease in corneal endothelial cell density and the coefficient of variation by cell size significantly increased for high risk proliferative diabetic retinopathy.

Study by Morikuba S et al. [12] has shown increase in the corneal thickness was greater on post-op day one among diabetic patients. The same study also showed that corneal endothelial loss was maximal at 1st week after operation. It said that the corneal endothelium in diabetic patients is under metabolic stress, and weakness against mechanical loads such as cataract surgery, than that in non-diabetic subjects. Hence compared with non-diabetic subjects, eyes of diabetic patients showed more damage in corneal endothelial cells after cataract surgery and a delay in the post-operative recovery of corneal edema.

Pigments Dispersion over IOL noted in 1 (4.35%) of the cases in diabetics as compared to 1 (10%) in the group B. Which was equal in both the groups. Onakpoya H Oluwatoyin et al. [9] showed increase amount of pigment over IOL in diabetic patients compared to non-diabetic.

In this study, total 8 (34.78%) eyes in diabetic group and three (30%) eyes in the non-diabetic group had anterior chamber reaction. 19% of diabetic & 7% of non-diabetic patients with grade II cells and flare on 1st post-operative day, 10% in the diabetics group A & 4% in non-diabetic group B had grade I cells & flare. Grade III was found in 8% in the diabetics group A & 4% in non-diabetic group B and grade IV was found in 3% of the patients in diabetic group and 3% in non-diabetic group.

Cystoid macular edema was noted in 3 (13.04%) in diabetic 3 (30%) of non-diabetic eyes post-operative 6th week. clinical and angiographic cystoid macular oedema, postoperative inflammation, prolong surgery, wound size and posterior capsular rupture or vitreous loss are the influencing factors.

The LEC's proliferate in response to many factors; one of these triggers is inflammation. It has been suggested that surgical invasion and contact with the IOL stimulate residual LECs to produce cytokines such as interleukin-1 (IL-1), IL-6, IL-8, basic fibroblast growth factors and transforming growth factor-ß. These cytokines may in turn affect epithelial cells as autocrine or paracrine factors and induce collagen production and fibrous proliferation. Thus, the degree of postoperative inflammation may be related to the development of PCO [13].

Diabetic and non-diabetic patients have no significant change in PCO after 6 week POD cataract surgery in our study. Opacification of the posterior capsule undoubtedly interferes with postoperative fundoscopy of the retina, retinal photocoagulation,

and even vitreous surgery, which is necessary in some cases. Therefore, it is important to maintain transparency of the posterior capsule in patients with diabetes for view fundoscopy, retinal photocoagulation, and even vitreous surgery.

Visual Acuity was measured by using Snellen's visual acuity chart and the values were converted to log MAR units for statistical analysis. Majority of the patients, 36 (72%) in the diabetic group A and 40 (80%) in the non-diabetic group B had visual acuity of 6/9 or better at the end of 6 weeks of follow up. 2 patients in the diabetic group and 2 patients in the non-diabetic group had visual acuity less than 6/60. This was due to PCO and Cystoid macular oedema in the patients. The mean post-operative best corrected visual acuity in log MAR units in the diabetic group was 0.30 + 0.4 and in the control group was 0.28 + 0.5. On comparing the post-operative values in both the groups the p value was (<0.2) which was not statistically significant. Both the groups have good visual acuity following cataract surgery. That means similar visual outcome in diabetic and no diabetic patients without retinopathy prior to surgery in diabetic's patients.

Conclusion

The visual outcomes following small incision cataract surgery with PCIOL in diabetics and non-diabetics. The pre-operative visual acuity was compared to the post-operative best corrected visual acuity in both the groups and the P value was statistically significant (p=0.01). The post-operative complications like corneal oedema and anterior chamber reaction are more common in diabetics that were observed during the study were significantly more in the diabetic group when compared to the non-diabetics. Patients with no diabetic retinopathy or maculopathy do not require any special management if cataract surgery was uncomplicated. Visual acuity is similar in both groups.

Therefore, we concluded that small incision cataract surgery in diabetics without diabetic retinopathy yields similar visual outcomes as non-diabetics.

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Original Article

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Evaluation of Anterior Chamber Angle by Ultrasound Biomicroscopy and Gonioscopy in Glaucoma Patients and Glaucoma Suspects

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Abstract

Glaucoma is the second most common cause of blindness and the leading cause of irreversible type of blindness worldwide. *Objective:* To correlate the angles assessed and categorized by gonioscopy, with the quantified value of angles by the UBM. *Method:* Participants: Patients having open and closed angles coming to the glaucoma clinic were selected for this study. Grade 0 to Grade 4 were assigned to temporal quadrants of the angles of participants using Shaffer's classification. Quantification of angles was done by ultrasound biomicroscopy (UBM) using following biometric parameters namely- Angle opening distance at 500µ (AOD 500) from the scleral spur and trabecular meshwork-ciliary process distance (TCPD). Schaffer's Grade 0,1 and 2 were classified as "narrow angles" and Schaffer's Grade 3 and 4 as "open angles". *Outcome Measures:* Measurements of UBM were calculated and analyzed in relation to measurements of Gonioscopy. *Results:* Two hundred eyes of 100 patients were analyzed. 96 eyes had "narrow angles" and 104 eyes had "open angles" on gonioscopy. The difference of means calculated by UBM and angle grade estimated by Gonioscopy was significant ($p<0.001$). The Pearson correlation coefficient was calculated using all UBM parameters and gonioscopy grades which came out significant at the 0.01. *Conclusions:* The estimated of angle width done by gonioscopy significantly correlated with the angle dimensions those measured by the UBM. Gonioscopy, is thus a reliable method for estimation of the angle width, although it is a subjective test.

Keywords: Glaucoma; Ultrasound Bio-Microscopy; Gonioscopy; Aod; Tcpd.

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Introduction

Glaucoma is the second most common cause of blindness and the leading cause of irreversible type of blindness worldwide [1].

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The assessment of the anterior chamber angle (ACA) is critical in differentiating POAG from PACG. This can be done clinically by different methods like Van Herick's method, Smith method and gonioscopy [2]. Gonioscopy is considered the mainstay for assessment of the angle by directly visualising the anatomic relationships of iris, cornea and anterior chamber angle structures. There are three grading systems have been proposed for documenting angle findings seen in gonioscopy: Scheie, Schaffer and Spaeth classification [2].

Although gonioscopy is considered the gold standard for clinical evaluation of the angle, certain limitations are, subjective nature of this technique and so is limited by inter-observer variation in the assessment and diagnosis [3]. Secondly, there are no criteria which is universally accepted for determining the anatomic threshold that justifies treatment to prevent PACG.

The advancement in high resolution imaging techniques has made possible better and reproducible imaging of anterior chamber angle anatomy. High frequency Ultrasound Biomicroscopy (UBM) was the first method followed by Pentacam, Optical Coherence Tomography (OCT), Scheimpflug Photography and Scanning Peripheral Anterior Chamber Depth Analyzer (SPACS) [4].

The application of these technologies to the ACA has led to the definition of a variety of quantitative parameters. These parameters are- angle opening distance (AOD), the trabecular – iris space area (TISA), angle recess area (ARA) and the trabecular-ciliary process distance (TCPD). The location of measuring these parameters is 500 or 750 μm anterior to the scleral spur.

These parameters make the comparison of different imaging devices possible and also help in assessing correlations between the quantitative information and qualitative information that is available through imaging and semi quantitative and qualitative information derived from gonioscopy [4].

Agreement in the diagnosis of angle closure glaucoma between gonioscopy and UBM has not been well studied previously in India. Hence we undertook the present study to see if gonioscopy and UBM findings are in accordance with each other in known cases of glaucoma and glaucoma suspects in a tertiary care hospital of central India.

Objective

To correlate the angles assessed and categorized by gonioscopy, with the quantified value of angles by the UBM.

Methodology

This observational study was carried out at the Glaucoma clinic of a tertiary care referral institute March 2015- August 2016. A total of 100 patients fulfilling the following criteria were enrolled-

Inclusion criteria

1. Known cases of POAG
2. Patients with ocular hypertension
3. Those with spectrum of primary angle closure such as primary angle closure suspects (PACS), primary angle closure (PAC) and PACG

Ethical approval was obtained by the institute ethics committee. Informed consent was taken from all participants who were willing to participate in the study.

Patients underwent a series of baseline examination in including best corrected visual acuity (BCVA), intraocular pressure (IOP), anterior segment evaluation by slit lamp examination, clinical assessment of central and peripheral anterior chamber depth and optic nerve head evaluation by slit lamp biomicroscopy.

Subsequently, the subjects were assessed for their present status of angle of the anterior chamber by gonioscopy and UBM. For maintaining uniformity amongst the measurements, temporal quadrants of all angles were analyzed for both Gonioscopy and UBM.

Gonioscopy

Gonioscopy was done in a semi-darkened room with minimum-possible slit lamp illumination, using a Goldman single-mirror goniolens. A drop of topical anesthetic was instilled in the patient's eye and some lubricant gel was put over the concave part of the lens. After pulling down slightly on the lower lid the lens was placed on the surface of the eye. The inferior angle was examined first followed by superior, nasal and temporal and all the angle structures were identified in each quadrant. Similar procedure was repeated for the other eye. The angles were categorized as "narrow angles" (Shaffer's grade 2 or less) and "open angles" (Shaffer's grade 3 and 4) according to Shaffer's classification [16].

UBM (Ultrasound Biomicroscopy)

The UBM Model ReflexTM, Reichert Technologies, with a 50 MHz transducer probe was used to conduct all the examinations for the purpose of this study. It has a penetration depth of around 4-5mm and has a lateral and axial physical resolution of approximately 50μ and 25μ respectively

As done in gonioscopy, UBM is also performed in a semi darkened room for all patients. Instillation of 4% lignocaine drops was done and a plastic eyecup was used to gently part the lids, so as not to exert pressure on the globe. The probe was moved manually perpendicular to the structure to be scanned while keeping the patient supine. Patient was made to target on the ceiling by the fellow eye keep the fixation constant.

Blinding was ensured for the measurements obtained. Due to different echogenic properties,

the ciliary body and sclera could be readily differentiated on the UBM. On performing longitudinal scan across the limbus, the anterior-most point of the demarcation line between the ciliary body and sclera was identified as the scleral spur.

AOD 500 and TCPD of the patients were evaluated in the present study.

1. *The Angle-opening-distance (AOD):* This was defined as the perpendicular distance from the corneal endothelium to the anterior iris, at a given distance from the scleral spur. The calculation done at a distance of 250μ (AOD 250), consistently falls on trabecular meshwork. Similarly, at 500μ(AOD 500) measure the angle opening anterior to the trabecular meshwork.

2. *The Trabecular-ciliary process distance (TCPD):* This was measured 500μ anterior to the scleral spur from a point on the trabecular meshwork, extended perpendicularly through the iris to the ciliary process. The TCPD defines the port through which the iris must traverse and has implications as to the potential maximal angle opening. AOD-500 and TCPD were measured for individual patients. At the temporal quadrant, standard axial scans were obtained thrice. Mean calculation of three readings was done in each case.

Statistical analysis was done to compare the UBM measurements and gonioscopy findings. The Independent Samples t-test was applied for the comparison of UBM parameters and gonioscopy findings. For the co-relation analysis of the gonioscopic estimation of the angle width and the UBM quantification of the same angle grade, the Pearson Correlation coefficient was used.

Results

A total of 100 patients (200 eyes) who fulfilled the inclusion criteria for the present study were enrolled. The age of our patients ranged from 35 years to 76 years with a mean age of 57 ± 13.4 years. The maximum number of patients in our study were in the age group of 50-60 years (44%), followed by those >60 years (28%), 40-50 years (18%) and < 40 years (10%). The male: female ratio was 1.63:1 (males = 62%, females= 38%) and this difference was statistically insignificant (p=0.56).

The mean age of males and females and gender distribution according to type of glaucoma was calculated. In the narrow angle group, the mean age of women (51 ± 13.1) was less than men (55 ± 14.3), but the difference is statistically insignificant. Similarly in the open angle group mean age of women (62 ± 11.6) was less than men (63 ± 14.6), but statistically insignificance. Narrow angle was found in our study in 30 males and 18 females, 32 males and 20 females were categorized in open angle group (Table 1).

Table 1: Gender distribution of patients according to type of glaucoma

	Male	Female
Narrow angle (n=96)	30	18
Mean age ± SD (years)	55 ± 14.3	51 ± 13.1
Open angle (n=104)	32	20
Mean age ± SD (years)	63 ± 14.6	62 ± 11.6

Classifying the angles into narrow or open angle by gonioscopy, we found that 16 eyes (8%) had grade 0 angle, 34 eyes (17%) had grade 1 while 46 eyes (23%) had grade 2 angle, thus categorizing 96 eyes (48%) into the narrow angle group. Of the remaining 104 eyes with open angles, 68 eyes (34%) had grade 3 angle and 36 eyes (18%) had grade 4 angle (Table 2).

Table 2: Grading of angles by gonioscopy

Gonioscopy grade (n)	No. of Eyes (%)
Grade 0	16(8%)
Grade 1	34(17%)
Grade 2	46(23%)
Grade 3	68(34%)
Grade 4	36(18%)

In the comparison of angles graded by gonioscopy and UBM, 96 angles were graded narrow (Shaffer's grade 2 or less) by gonioscopy while 92 by UBM, and 104 angles were graded open (Shaffer's grade 3 and 4) by gonioscopy while the number of open angles measured by UBM was 108, but the difference was statistically insignificant (p value >0.05). The mean value of AOD 500 and TCPD in the narrow angle group was 112 ± 93μ and 623±120 μ respectively while in open angle group it was 342 ± 56μ and 956 ± 136μ respectively. The difference for both values in the two groups was found to be statistically significant. For AOD 500 p value is <0.00001 and for TCPD p value is <0.017126 (Table 3).

Table 3: Comparison of angles graded by gonioscopy and UBM

Angles	Gonioscopy	UBM	p value
Narrow	96	92	0.688625
Open	104	108	0.688625

The temporal angles of 16 eyes were categorized by gonioscopy as Grade 0, 34 angles were Grade 1, 46 angles were Grade 2, 68 angles were Grade 3 and 36 eyes had Grade 4 angles (Table 4). We observed

that both the AOD 500 and TCPD values increased successively with the increasing grade of the angle. The corresponding mean value of AOD 500 and TCPD for grade 0 angle was 16.7 ± 14.2μ and 567 ± 102.6 μ respectively, for grade 1 angle was 96 ± 36.4 μ and 665 ± 132.5 μ respectively, for grade 2 angle was 186 ± 80.7 μ and 736 ± 102.4 μ respectively, for grade 3 angle was 272 ± 50.6 μ and 874 ± 103.1 μ respectively and for grade 4 angle was 346 ± 30.6 μ and 972 ± 76.5 μ respectively (Table 5).

Table 4: Mean UBM measurements of temporal angles graded as Narrow VS Open by Gonioscopy

Angle parameters (mean ± SD)	Narrow angle (n = 96)	Open angle (n = 104)	p value
AOD 500	112 ± 93μ	342 ± 56μ	<0.00001
TCPD	623 ± 120μ	956 ± 136μ	<0.017126

Table 5: Mean UBM measurements of angles categorized by gonioscopy

Gonioscopy grade (n)	AOD 500 (μ) (mean ± SD)	TCPD (μ) (mean ± SD)
0 (n=16)	16.7 ± 14.2	567 ± 102.6
1 (n=34)	96 ± 36.4	665 ± 132.5
2 (n=46)	186 ± 80.7	736 ± 102.4
3 (n=68)	272 ± 50.6	874 ± 103.1
4 (n=36)	346 ± 30.6	972 ± 76.5

Discussion

For the diagnosis of narrow angles, Gonioscopy still remains the mainstay. Assessment of the risk of angle closure is done commonly by the Shaffer grading system. The cut-off between open and narrow angles is grade 2[19] and measurement is subjective, giving only approximate angle which are recorded in degrees. Thus, it provides only an estimation of the angle width[9]. There is disagreement between glaucoma subspecialists, as to the grading of the angle and its occludability[7]. Keeping this in mind, Congdon et al[20] developed biometric gonioscopy system so that inter-observer reliability improves and cut-off angles for screening may be defined.

Ultrasound Biomicroscopy has brought revolution by making possible the quantitative assessment of iris curvature and degree of angle opening. Clinicians can now determine the state of closure of the entire angle, even when it cannot be visualized by gonioscopy. The general configuration of the iris in normal patients is planar or has a gentle anterior convexity[21]. A relative pupillary block results in an anteriorly bowed iris, with a corresponding decrease in angle opening. The AOD 250 is a measure of the angle opening at the level of the posterior trabecular meshwork, while the AOD 500 is a measure of the angle opening at the level of the anterior Schwalbe's line. The AOD measured by the UBM may thus reflect the amount of relative pupillary block in eyes with narrow angles [22].

The TCPD, as reported by Pavlin et al is a particularly important parameter, since it defines the space available for the iris between the trabecular meshwork and ciliary process and is a main feature in an individual eye. The TCPD is the sum of three segments: the angle opening 500μ from the scleral spur; the thickness of the iris at that point and the width of the ciliary sulcus.

Out of a total of 100 patients the maximum number (44%) of patients was in the age group of 50-60 years with a mean age of 57 ± 13.4 years. Amongst patients with narrow angle glaucoma, the mean age was 53 ± 13.6 years while in open angle glaucoma patients, the mean age was 63 ± 12.8 years.

There was no significant gender predilection seen in our study (M:F = 1.63:1). Similar observation was made by Narayanaswami et al., (2004) [11] in their study on 500 patients which had 282 men and 218 women with a mean age of 57.32 ± 12.48 years.

In contrast, Kaushik S et al. (2006) [12] in their study on 163 patients had more females (71 males and 92 females). The mean age of males was higher in patients with narrow angle (58.3 ± 13.1 years v/s 53.2 ± 14.3years) while in patients with open angle females (64.4 ± 12.6 years) had a higher mean age compared to males (62.3 ± 14.6 years).

Our study revealed 96 eyes having narrow angles and 104 eyes with open angles. The maximum no. of eyes had a Schaffer's grading of grade 3 by gonioscopy (n=68; 34%) while the least common grading was grade 0 seen in 16 eyes (8%).

Kaushik S et al. (2006) [12] in their study had 106 eyes had narrow angles while 57 eyes had narrow angle by gonioscopy and in their study also the most common grading was grade 3 in 42 (25.7%) eyes. However, in contrast to our observation the least common grade in their study was grade 4 (n=15; 9.2%).

When we compared the grade of the angle by gonioscopy and UBM, we found good agreement between both techniques. Out of a total of 200 angles assessed grading of only 4 angles (2%) showed discrepancy. They were graded as narrow by gonioscopy, but UBM examination showed them as open angle. This difference was statistically

insignificant ($p > 0.6$).

Similar observations have been made by studies of Spaeth et al. (1995) [23], Narayanaswami et al. (2004) [11], Kaushik S et atl. (2006) [12], Barkana Y et al. (2007) [13] and Liu RJ et al. (2014) [17].

However the study by Wang N et al. (1999) [8] concluded that angles examined by gonioscopy were wider as compared to UBM especially when the angles were narrow.

Both the AOD 500 and TCPD values for narrow angles were less compared to those for non-occludable angles and the difference for both was statistically significant ($p < 0.00001$).

Similar findings were also documented by Kaushik S et al. (2006) [12] in their study

In our study we observed that the mean AOD 500 and TCPD values showed a gradual increase as the width of the angle increased from grade 0 to grade 4.

The mean AOD 500 values were smallest (16.7 ± 14.2) for grade 0 angles and highest (346 ± 30.6) for grade 4 angles. Similarly TCPD values were least (567 ± 102.6) for grade 0 and highest (972 ± 76.5) for grade 4.

Our findings are in accordance with those of Garudadri CS et al. (2002) [24] and Kaushik S et al. (2006) [12].

In a study conducted by Narayanaswami et al. (2004) [11], AOD 500 correlated well with angle width. All biometric parameters, except for lens thickness, were significantly lower in eyes with occludable angles in comparison with eyes with non-occludable angles.

According to published reports of UBM measurements in Indian eyes, the findings are as follows: Narayanaswamy et al. (2004) [11] found a tendency to overestimate the angle width by gonioscopy compared to the UBM, while in the study conducted by Kaushik S et al. (2006) [12], UBM measurements and gonioscopic assessments of the angle width were significantly correlated. Another study done by Garudadri et al. (2002) [24], used different method of estimating the AOD 500 and TCPD and thus the results are not comparable to the present study.

In the present study, UBM measurements and gonioscopic features of the angle width correlated significantly. This indicates that although being a subjective evaluation, gonioscopy appears to provide accurate information with regard to the angle width estimation. Angle closure is now being considered as a major problem in India. The Andhra Pradesh eye disease study25 reported that 2.21% of the population > 40. 0 years, had occludable angles at risk of angle closure and 1.08% had manifest PACG, a large proportion of who were undiagnosed and untreated. In the Vellore eye study26 manifest PACG was as high as 4.3%. As visual loss resulting from PACG is potentially preventable if peripheral iridotomy is performed at an early stage, strategies for the early detection of PAC could reduce the risk of blindness resulting from PACG.

Conclusion

In conclusion UBM is a new method of imaging the anterior segment of the eye at high resolution. Although histological assessment of various disease types is sometimes available from pathology specimens, this usually occurs at a late stage in the disease and is susceptible to the inevitable distortions of the preparation process. UBM, though lacking the resolution of optical microscopy, gives us images in living eyes without affecting the internal relationships of the structures being imaged. UBM has proven to be valuable in both clinical practice and ophthalmic research.

In spite of the advent of the UBM for quantitative estimation of the anterior chamber angle, gonioscopy remains the reference standard for differentiating appositional from synechial angle closure and quantifying the extent of peripheral anterior synechiae, in addition to characterizing the anatomic appearance of the anterior chamber angle. It is appropriate for use in Asian countries like India, where the angle closure glaucoma is highly prevalent and access to quantitative methods like the UBM is limited. Mandatory use of gonioscopy would probably help towards reducing the morbidity from PACG by earlier diagnosis and timely management of occludable angles.

From the present study we can conclude that gonioscopy appears to be equally effective in grading the anterior chamber angle as compared to UBM grading in Indian eyes.

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Original Article

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Awareness of Diabetic Retinopathy among General Practitioners in A Rural Area of North Karnataka

Veeresh Korwar[1], Rajashree Reddy[2]

Abstract

Introduction: Type 2 Diabetes Mellitus (DM) is a very common chronic condition which has affected almost 382 million people worldwide. Currently, about 62 million people in India are diagnosed with DM, and has the highest number of diabetics in the world.The prevalence of diabetes is predicted to double globally from 171 million in 2000 to 366 million in 2030 with a maximum increase in India.

This number is predicted to reach 79.4 million by the year 2030. Development of diabetes related complications are not uncommon and are insidious in onset. These complications are responsible for various co-morbidities which affect the quality of life. Diabetic retinopathy is the main cause of visual impairment and blindness among the people suffering from diabetics. The prevalence of diabetic retinopathy is estimated to be around 33.9% in patients suffering from DM. Visual impairment due to diabetic retinopathy is observed in more than 86% of Type 1 Diabetic patients and 33% of Type 2 Diabetic patients. Over the last 2 decades, diabetic retinopathy has emerged as a common cause of ocular morbidity and blindness in India, moving up from number 17 (1986-1989 WHO-NPCB Survey, Government of India) to number 6 (2001–2002 NPCB national survey) in the list of causes of blindness.

In this study we tried to assess the awareness about the various common aspects of Diabetes Mellitus, knowledge about the visual loss in Diabetic retinopathy and the different modalities of treatment available for Diabetic retinopathy among the general practitioners practicing modern medicine (MBBS doctors) and indigenous medicine (BAMS doctors) working in rural areas of North Karnataka .

Materials and Methods:

Study design: The study was a descriptive cross-sectional survey conducted between October 1, 2016 and December 14, 2017 in rural areas of north karnataka. Institutional approval was obtained from the hospital research and ethics committee before commencement of the study.

Study Population:The study respondents were general practitioners (GPs), practicing modern medicine (MBBS doctors) and indigenous medicine (BAMS and BHMS doctors) and working in rural areas of north karnataka.

Study Protocol: A total of 179 general practitioners (GPs) participated in the study out of which 49 were BAMS, 72 BHMS and58 MBBS doctors. Informed consent was taken and confidentiality of subjects was maintained. All the participants were given a pre-tested structured questionnaire. The questionnaire consisted of two sections A and B. Section A had questions pertaining to the general awareness of DM and section B regarding the knowledge and various treatment modalities available for diabetic retinopathy. Each correct answer was allotted one mark each. The extracted data was analyzed using Microsoft Excel.

Results: Over all 179 doctors of various discipline participated in the study, out of which 49 (27%) were practicing Ayurveda, 72 (41%) were practicing Homeopathy and 58 (32%) were practicing Allopathy. Majority i.e., 128 (72%) of the respondents were male and 51 (28%) were female. There were 58 (32%), 44 (25%), 39 (22%) and 38 (21%) respondents in the 31–40 years, 41–50 years, 51 years or older and 21 – 30 years age categories, respectively. Majority 167 (93.29%) were aware that Diabetes Mellitus effects the eye.

Conclusion: Diabetic retinopathy remains the main cause of visual impairment and blindness among the people suffering from diabetics. Hence, early detection and intervention helps to reduce the loss of vision due to diabetic retinopathy. Our study found that there is a lot of scope for improvement in knowledge and awareness related to diabetes and diabetic retinopathy among general practitioners. Workshops/CMEs/Guest lectures/Seminars will help them to update their knowledge and is the need of the hour to improve the ocular health outcomes especially in diabetic patients.

Keywords: Diabetes; Diabetic Retinopathy; Blindness.

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Introduction

Type 2 Diabetes Mellitus (DM) is a very common chronic condition whichhas affected almost 382 million people worldwide [1]. Currently, about 62 million people in Indiaare diagnosed with DM, and has the highest number of diabetics in the world [2]. The prevalence of diabetes is predicted to double globally from 171 million in 2000 to 366 million in 2030 with a maximum increase in India. This number is predicted to reach 79.4 million by the year 2030 [3].

Development of diabetes related complications are not uncommon and are insidious in onset. These complications are responsible for various co-morbiditieswhich affect the quality of life [4,5] Diabetic retinopathy is the main cause of visual impairment and blindness among the people suffering from diabetics. The prevalence of diabetic retinopathyis estimated to be around 33.9% in patients suffering from DM. Visual impairment due to diabetic retinopathy is observed in more than 86% of Type 1 Diabetic patients and 33% of Type 2 Diabetic patients [6] Over the last 2 decades, diabetic retinopathy has emerged as a common cause of ocular morbidity and blindness in India, moving up from number 17 (1986-1989 WHO-NPCB Survey, Government of India) to number 6 (2001–2002 NPCB national survey) in the list of causes of blindness [7].

Majority of the diabetic patients in India, visit the general practitioners for the treatment of their medical as well as visual problems. In villages, where the services of specialists are rare, the MBBS (Bachelor of Medicine and Bachelor of Surgery), the BAMS (Bachelor of Ayurvedic Medical Sciences) and the BHMS (Bachelor of Homeopathic Medical Sciences) doctors are often the first level of contact for health services. Hence, it is important for them not only to be aware of diabetes and its complications, but also to refer the patients at an appropriate time to trained ophthalmologist for ocular examination to prevent further complications.

In this study we tried to assess the awareness about the various common aspects of Diabetes Mellitus, knowledge about the visual loss in Diabetic retinopathy and the different modalities of treatment available for Diabetic retinopathy among the general practitioners practicing modern medicine (MBBS doctors) and indigenous medicine (BAMS doctors) working in rural areas of Ahmednagar district.

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Results

Over all 179 doctors of various discipline participated in the study, out of which 49 (27%) were practicing Ayurveda, 72 (41%) were practicing Homeopathy and 58 (32%) were practicing Allopathy. Majority i.e., 128 (72%) of the respondents were male and 51 (28%) were female. There were 58 (32%), 44 (25%), 39 (22%) and 38 (21%) respondents in the 31–40 years, 41–50 years, 51 yearsor older and 21–30 years age categories, respectively. Majority 167 (93.29%) were aware that Diabetes Mellitus effects the eye.

Table 1 shows that 68 (38%) of the general practitionerswere aware about all the three classical symptoms of DM i.e., polyuria – excessive urination (60.89%), polydypsia – excessive thirst (46.93%) and polyphagia – excessive intake of food (37.99). Only 15 (8.38%) respondents were aware that non healing wound isalso a symptom of DM. Regarding the investigations for DM, majority 144 (80.45%) responded that rely on urine test the most, followed by Random Blood Sugar Levels i.e., 134 (74.86%). GTT was rather unpopular among the doctors as only 33 (18.44%) were aware. The table also depicts the awareness of risk factors, which reveals that 110 (61.45%) respondents were aware of hereditary factors as a risk factor, followed by obesity 82 (45.81%), inadequate Physical work 48 (26.82%) and pancreatic defect 3 (1.68%). The awareness of organs affected due to DM were eye 167 (93.30%) followed by heart 128 (71.51%), kidney 116 (64.80%), nervous system 35 (19.55%) and foot 11 (6.15%).

Table 1: Awareness of various variables in Diabetes Mellitus

Awareness of symptoms	Aware (n)	Percentage
Excessive urination	109	60.89
Excessive thirst	84	46.93
Excessive hunger	68	37.99
Non healing wounds	15	8.38
Awareness of investigations	**Aware (n)**	**Percentage**
Urine	144	80.45
BSL-R	134	74.86
BSL-F	129	72.07
BSL-PP	120	67.04
GTT	33	18.44
Awareness of risk factors	**Aware (n)**	**Percentage**
Hereditary	110	61.45
Pancreatic defect	03	1.68
Obesity	82	45.81
Inadequate Physical work	48	26.82
Awareness of the organs affected	Aware (n)	Percentage
Eye	167	93.30
Heart	128	71.51
Kidney	116	64.80
Foot	11	6.15
Nervous system	35	19.55

A total of 153 (85.47%) general practitioners have heard about diabetic retinopathy, out of which 148 (82.68%) were aware that it affected the vision. 141 (78.77%) doctors responded that the visual loss is reversible in early stages & irreversible in late stages. Majority 152 (84.92%) opined that DR is treatable. Almost half of the respondents i.e., 89 (49.72%) commented that DM patients with eye complaints should be referred to ophthalmologist and 166 (92.74%) doctors suggested that every patient with DM should have regular eye checkup.

Table 2: Awareness of Diabetic Retinopathy (DR) among the doctors

Parameters	Yes (n)	Percentage
Heard of DR	153	85.47
DR causes loss of vision	148	82.68
Visual loss is reversible in early stages & irreversible in late stages	141	78.77
Diabetic Retinopathy is treatable	152	84.92
Every patient with DM should have regular eye checkup	166	92.74
DM patients with eye complaints should be referred to ophthalmologist	89	49.72
Aware of DR	96	53.63

Table 3 depicts the awareness of various treatment modalities available for DR. Laser intervention 91 (50.83%) was the most common response followed by medical intervention 67 (37.43%), surgery 63 (35.19%) and others 17 (9.49%).

Table 3: Treatment modalities available for DR

Treatment modalities	Response	
	N	Percentage
Medical	67	37.43
Surgical	63	35.19
Laser	91	50.83
Others	17	9.49

Discussion

The leading cause of visual impairment and blindness is DR. With the recent trend being increase in the number of diabetic patients, diabetic retinopathy is an issue of great concern. Accordingly, early detection, timely ocular treatment and good control of the risk factors are important for reducing blindness due to diabetic retinopathy.

The general practitioners constitute an important part of the diabetic care network [8]. In India, in

addition to allopathic medicine, up to 80% of the population use Ayurvedic and other traditional medicines, often exclusively [9]. Hence it becomes the duty of all general practioners irrespective of their branch to have a basic idea of DR.

This study assessed the general practitioners knowledge on awareness of DM and DR. It was observed that the awareness of the presenting symptoms of DM waslow (38%). The most common symptom that majority were aware was polyuria (60.89%). However only 15 (8.38%) believed that DM may also present as any non healing ulcer. This may be attributed to the non homogenous study population which consisted 68% of non allopathic doctors.

The investigations that are necessary to diagnose DM were known by almost 67% of the doctors. Majority 144 (80.45%) were aware that urine for sugar can be used to diagnose DM. Awareness regarding blood sugar level (BSL) was known to majority of them, 74.86% followed by random blood sugar level (BSL), 72% fasting blood sugar level (BSL) and 67% post prandial blood sugar level (BSL). It was observed that the gold standard investigation for diagnosing DM i.e., Oral Glucose Tolerance Test was known by only 33 (18.44%) doctors.

DM having a hereditary cause was known by 61% of the doctors. Only 1.68% of the doctors were aware that pancreatic defect has a role in DM. Majority (93.30%) were aware that DM in due course affects eye. The also study revealed the awareness about the organ affected due to DM which were heart (71.51%) kidney (64.80%)and nervous system (19.55%). However only 11 (6.15%) of the doctors were aware that foot is also affected. The gross variation in the results again may be attributed to the heterogeneous nature of the group which includes doctors practicing Ayurveda, Homeopathy and Allopathy.

Our study revealed that 96 (53.63) general practitioners had adequate knowledge about DR. A total of 5questions were asked in questionnaire to assess the knowledge of DR. Any respondent who had answered 4 or 5 questions correctly was considered to have adequate knowledge. A study conducted by Narendra P.D et al on level of awareness about DR among physicians in rural district of Kolar revealed that 55% doctors had adequate knowledge while 12.20% were unaware and 25% were partially aware [10]. Another study conducted in Punjab found that 53% BAMS and 75% MBBS doctors were adequately aware about epidemiology, risk factors and management of diabetic retinopathy while 47% BAMS and 25% MBBS were not adequately aware [11].

Nearly half of the respondents opined that laser treatment can help to restore the vision. About 37% of them reveled that medical management will help and 35% believed surgical management will be useful. However, 17 (9.49%) believed that there are other methods to treat DR apart from medicines, surgery and laser. A similar study conductedin Punjab found that 69.3% general practitioners knew about laser photocoagulation [11]. Another study conducted by Narendra P.D. et al. showed results similar to the study [10].

More than half (55%) of the general practitioners reveled that they do not prescribe any medicine if a Diabetic patient complains of eye problems without consulting Ophthalmologist. Majority (85%) knew the importance of maintaining optimum blood sugar level and they counsel the importance of it to the patients. Our study also revealed that about 93% of the general practitioners would counsel their patients for regular eye check up at ophthalmologist.Majority (89%) of them concluded that they would like to attend Workshops/CMEs/ Guest lectures/Seminars regularly to upgrade their knowledge on diabetic retinopathy.

Conclusion

Diabetic retinopathy remains the main cause of visual impairment and blindness among the people suffering from diabetics. Hence, early detection and intervention helps to reduce the loss of vision due to diabetic retinopathy. Our study found that there is a lot of scope for improvement in knowledge and awareness related to diabetes and diabetic retinopathy among general practitioners. Workshops / CMEs / Guest lectures/ Seminars will help them to update their knowledge and is the need of the hour to improve the ocular health outcomes especially in diabetic patients.

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Retinopathy of Prematurity (ROP): A Curse for Low Birth Weight Neonates

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Abstract

Introduction: Advances in neonatology and ventilator systems, results in exposure of preterm and low birth weight babies to high oxygen concentration there by leading to initiating ROP. This study was done to identify the incidence, risk factors, for the ROP formation in Neonatology ICU at a tertiary care hospital in South India. *Methods:* Pre term babies with gestational age less than 32 weeks and wright less than 1750 gm were included in the study. Babies were followed up till complete vascularization of retina. Risk factors and details of ROP were recorded in the proforma. *Results:* Seventy two babies were thus examined. The incidence of ROP is 8.33% in the study group and it peaks at 38.46% in babies ≤ 30 weeks gestation and/or ≤ 1250 gm birth weight. RDS, Apnea, Sepsis, oxygen administration, ventilation, hyperoxia and hypoxia are independent risk factors significantly associated with ROP ($p<0.05$). *Conclusion:* Ongoing ROP screening programme is recommended to all babies ≤ 32 weeks gestation age and/or ≤ 1750 gm birth weight at 4 weeks after birth by indirect ophthalmoscopy. Screening of babies ≤ 30 weeks gestation and /or ≤ 1250 gm birth weight would be more cost effective. It would detect the more severe stages of ROP easily enough to permit treatment, reduce unnecessary examinations and avoid wastage of time and manpower. Screening should be intensified in the presence of riskfactors.

Keywords: ROP; Pre-Mature Baby; Hyperbaric Oxygen; Cryotherapy.

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Introduction

Retinopathy of prematurity (ROP) is a proliferative disorder of the retinal vessels peculiar to premature infants. The disease is entirely asymptomatic in early phase and has the potential of progressing to severe visual impairment [1]. Long term morbidity have a spectrum ranging from mild myopia to blindness. 90% of cases of ROP go on to spontaneous regression with little or no visual loss, fewer than 10% of the involved eyes progress to significant visual loss [2]. Hence detection of ROP require on going screening programme.

Advances in neonatology and increased survival of preterms have increased population of babies at risk for developing ROP. Although there are other risk factors, the incidence of ROP is inversely related to gestational age and birth weight with the greatest at risk group being in the low birth weight babies under 1500 grams, and especially infants with very low birth weight of less than 1000 grams [3].

Oxygen exposure, apnea, septicemia ventilation, respiratory distress syndrome blood transfusion, hypoxia, hyperoxia, hypercarbia, hypotension and intracranial hemorrhage are well recognized risk factors of ROP [4].

Studies in the literature use a cutoff point for high risk prematurity of a birth weight of 1,251gm or 1,501gm a gestational age of 32 or 28 weeks or both. The incidence of ROP is going to be higher if

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a lower weight (i.e. 1250gm) is used as the cutoff point. Study by the cryotherapy for retinopathy of prematurity co-operative group found evidence of ROP in 65.8% infants weighing less than I251g and in 80% of infants weighing less than 1,000 gm [5].

Reports from developing countries indicate that although the trend in ROP is not similar in all the units, there is an overall decrease in the incidence of disease wherever there is on going surveillance programme. Aggarwal and co-workers noted a drop in the overall incidence of ROP from 32% to 20% over a period of 8 years (Table1) [2].

Table 1: Incidence of ROP

Indian Studies	Inclusion criteria		Incidence
	GA (wks)	BW (gm)	
Dutta [12], 2004	≤ 32	≤ 1700	21%
Gupta [13], 2004	≤ 32	≤ 1250	21.7%
Maheshwari [14], 1996	≤ 35	≤ 150	20.0%
Pati [l4], 1997	≤ 32	≤ 1250	17.5%
International studies			
Conrath [11], 2001	≤ 32	≤ 1500	9.4%
Fledelius [15], 2000	≤ 32	≤ 1750	10%
Chye [16], 1999	≤ 37	≤ 1250	15.0%
Nair [17], 2003	≤ 32	≤ 1500	25.4%

Risk Factors for Development of ROP

ROP is a multifactorial disease and based on clinical and epidemiological studies, numerous risk factors for ROP have been proposed. Prematurity and oxygen are well recognized and accepted while others are controversial [6].

Definitive and well accepted

- Prematurity/ Gestational age (< 32 or 28weeks)/ Birthweight (< 1750gm)
- Oxygensupplementation

-Oxygen is the prime factor suspected of causing the initial insult leading to ROP. The concentration and fluctuation of oxygen are key factors. Sudden discontinuation of oxygen and duration of oxygen therapy are also incriminated in the pathogenesis of ROP [5].

-A definite safe range for arterial PaO_2 is not know, nor we know the critical duration of oxygen exposure. Until such guidelines are established, keeping PaO_2 < 100 m Hg is recommended preferably between 50 and 70 mm Hg and saturation between 90-95%.

Other associated risk factors

RDS	Hypercarbia/ Hypocarbia
Apnea of prematurity	Metabolic acidosis/ alkalosis
Septicemia	Ventilation
Blood transfusion	ICH
Hyperoxia/ Hypoxia	Hypotension
Asphyxia	Surfactant
	Vitamin E deficiency

Although ROP has been recognized as an important cause of blindness in developed countries for some years, it is now becoming more significant in developing countries. The world health organization's "vision 2020 programme" targets ROP as an avoidable disease requiring early detection and treatment to prevent blindness. As described by vision 2020, recent research has resulted in strategies that have been successful in reducing the incidence of ROP [7].

Current treatment options are expensive and can have potentially serious complications, thus prevention is still the best strategy available at present to avoid visual deficits caused by ROP [7]. Treatment options available are – retcam for follow up of the neonate, Cryotherapy, endolaser photocoagulation, pars planavitrectomy.

Aims

To identify the incidence and risk factors of ROP

Materials and Methods

-Informed consent of parents was taken after explaining in detail about the methods and procedures involved in the study in their own vernacular language. Institutional ethical committee clearance was taken.

- Prospective observational study , conducted in tertiary care hospital in South India
- 72 babies were included in the study
- The study period was one year

Inclusion Criteria

- Babies with gestational age 32 week orless.
- Babies with birth weight 1750gm orless.
- Babies with birth weight 1750-2000gm and 32-35 weeks of gestational age having sepsis, Apnea, Blood transfusion, respiratory distress syndrome and O_2 supplementation.

Methodology

Detailed history and risk factors were documented using a structured proforma. Sepsis was clinically suspected and confirmed by blood culture. Apnea is defined as cessation of respiration for ≤ 20 seconds or accompanied by bradycardia. Standard definitions were used to define other risk factors (Table 2). Gestational age was assessed by New Ballard Score.

Table 2: Risk factor definition

Metabolic acidosis	pH <7.25
Alkalosis	pH >7.45
Hypoxia	PaO_2< 50mm of Hg.
Hyperoxia	PaO_2 > 100 mm of Hg.
Hypercarbia	$PaCO_2$ > 50 mm of Hg.
Hypocarbia	$PaCO_2$< 25 mm of Hg.

Examination of eye for ROP was done by indirect ophthalmoscopy after dilating pupils with topical mydriatics (1% tropicamide + 2.5% phenylephrine) used twice or thrice at 15 minutes interval. The first indirect ophthalmoscopic examination was performed in NICU at 4-6 weeks of chronological age or 32 weeks of postconceptional age whichever was later by the same ophthalmologist and was not informed about the babies clinical details to eliminate the possibility of a biased examination. Feeding was avoided 30 minutes before examination neonatologist was present during examination of unstable babies. All aseptic precautions were taken and speculum used wherever necessary. If no ROP was detected at initial examination the infants were re-evaluated every 2 weeks until complete vascularization of retina. If ROP detected, frequency of follow up examination was decided by ophthalmologist based on stage of ROP. Details of ROP were recorded in the proforma as per International Classification of ROP [8].

Results

General Data

Seventy two (72) babies satisfying the inclusion criteria were included in the study. The incidence of retinopathy of prematurity is 8.33%. The mean gestational age of babies screened was 32.43 ≤ 1.89 weeks. The range of gestational age was 28 wks – 36 wks. Three fourth of them were more than 32 wks and 6.9% of them were below 29 wks. The mean birth weight of babies was 1544.48 ≤ 285.96 gm, 55.5% of them were above 1500 gm. Only 15.3% of them were below 1249 gm. The range of birth weight was 850 to 2000 gm. 61.2% of babies were inborn. 46 babies were males and 26 babies were females. Male: Female ratio is 2:1. No significant correlation of sex with ROP was found (p value =0.87)

Rop Profile

- 4 babies had stage I ROP (66.66%) and 2 babies had stage II ROP (33.33%). 4 (66.66%) babies had zone III ROP and 2 babies (33.33%) in zone II.

- Mean gestational age at which complete vascularization of retina was evident is 39.15 wks. 37.5% of babies had mature retina at 40 wks of gestational age.

- Mean gestational age of babies with ROP is 29.83 ≤ 1.33 wks. 83.3% i.e., 5 out 6 babies were below 30 wks of gestational age. Range is 28-32 wks. The incidence of ROP was found to be significantly inversely proportional to the gestational age of babies (p = 0.001).

- Mean birth weight of babies with ROP is 1228.33 ≤297.34 gm range is 900 gm to 1600 gm. 83.3% were below 1250 gm and one baby was 1600 gm. The incidence of ROP was found to be significantly inversely proportional to birth weight (p=0.004). Observation noted in our study that ROP was most common in babies less than 1250 gm and 32 wks of gestational age was also statistically significant (p=0.001).

- All six babies who developed ROP needed respiratory support and received oxygen. Four babies were ventilated. Two third of them had sepsis and apnea. 50% developed RDS, hypoxia and hypotension. Hyperoxia (PaO_2 > 100 mm Hg) was seen in all babies where as 50% of babies had hypoxia (PaO_2 < 50 mmHg). Half of them received blood transfusion and one baby had grade II intraventricular hemorrhage. Surfactant was administered in 33% of babies To establish association of ROP with risk factors, we proceeded to analyze data with univariate and multivariate analysis. (Tables 3,4). From univariate analysis, risk factors significantly associated with ROP are apnea, sepsis, oxygen, ventilation, hyperoxia, hypoxia and RDS. On multiple logistic regression analysis, none of the risk factors had statistically significant association with ROP.

Table 3: Univariate analysis of risk factors

Risk factors	Total babies	Babies with Rop	P value	Significance
BW (<1750 gm)	72	6	0.004	S

GA (<32 wk)	72	6	0.001	S
Sepsis	20	4	0.08	S
Apnea	20	4	0.08	S
Blood transfusion	0	3	0.87	NS
RDS	8	3	0.024	S
Oxygen	34	6	0.022	S
Ventilation	11	4	0.002	S
Hyperoxia	22	6	0.001	S
Hypoxia	06	03	0.002	S
Hypercarbia	03	00	0.913	NS
Metabolic acidosis	08	0	0.8921	NS
ICH	01	01	0.83	NS
Hypotension	14	03	0.151	NS
Surfactant	06	02	0.123	NS

Table 4: Multivariate analysis of risk factors

Risk	No. of factor	ROP cases	Estimation of parameter	Standard error	p. values
Sepsis	20	4	-5.810	307.335	0.985
Apnea	19	4	-5.816	307.335	0.985
RDS	08	3	0	2	1.000
Oxygen	34	6	0.10	491.901	1.000
Ventilation	11	4	0	2	1.000
Hyperoxia	22	6	22.865	449.332	0.959
Hypoxia	06	3	32.024	1055.432	0.976

Discussion

ROP is likely to become a significant problem in India with improving standards of neonatal care. A review of the literature showed a scarcity of data on the epidemiology of ROP from the Indian sub-continent [2]. Reports from developed countries indicate that although the trend in ROP is not similar in all the units, there is an overall decrease in the incidence of the disease wherever there is an ongoing surveillance programme [9].

Screening of babies with ≤30 wks of gestational age and/or ≤ 1250 gm birth weight in this study would have increased the incidence of ROP to 38.46%. This is comparable with results of Blair [10] (38%) and Conrath [11] (33%).

A question may be asked regarding absence of threshold disease in the present study. ROP is difficult to detect in its early stages but threshold disease is very obvious and cannot be missed by a trained examiner. Similar findings were noted by Patil and co-workers who reported only stage I and stage IIROP [4].

Risk Factors

Though accumulating evidence indicates that ROP is a multifactorial disease, immaturity of retina and a period of hyperoxia are the main contributing etiological factors in the pathophysiology of ROP [12]. In our study, the incidence of ROP was significantly inversely proportional to both birth weight and gestational age (p=0.001).

On univariate analysis, Oxygen administration, sepsis, apnea, RDS, ventilation, hypoxia and hypoxia are significantly associated with development of ROP. This is in comparison to findings of Agarwal [2] and Gupta [13]. In contrast, blood transfusion, which was a significant factor in both studies, is not associated with ROP in our study.

Oxygen

Oxygen administration is an independent risk factor for development of ROP (p=0.02). The causal link between ROP and supplemental Oxygen has been confirmed by controlled trials and clinical studies [14,15]. 17.2% of babies who received oxygen therapy developed ROP in the present study, whereas nearly half of the babies on oxygen therapy developed the disease in other studies [2,13]. Though hyperoxia was seen in 64.7% of babies who received oxygen, only 27.2% of them developed ROP in our study. This difference is due to close monitoring of babies on oxygen therapy by pulse oxymetry and arterial blood gas analysis in ourunit.

Sepsis

Sepsis is an independent risk factor for ROP in the present study (p=0.08) and corroborates with findings of other studies [2,13]. Gupta [13] in his study reported 52% sepsis among babies with ROP. In the present study too, 66% of babies with ROP have sepsis. Its prevention and early treatment may reduce the incidence of ROP.

RDS

RDS is significant independent risk factor in the present study (p=0.02). Of 8 babies who suffered from RDS in the study group, 37.5% developed any stage of ROP. Gupta [13] and associates reported ROP in 33.3% of babies with RDS, comparable to the present study. Surfactant used to treat hyaline membrane disease has been shown to reduce the risk of ROP. 75% of RDS babies received surfactant and only one fourth of them developed ROP. Surfactant did not significantly reduced the incidence of ROP

in the present study (p=0.12).

Apnea

ROP is known to be associated with apnea [2,13]. Two third of babies with ROP have apnea in the present study and is a significant risk factor (p=0.08). This can be compared to 54.1% and 54.5% as reported by Agarwal [2] & Gupta [13] respectively. Its appropriate management may reduce the incidence of ROP.

Ventilation

The present study is in agreement that mechanical ventilation significantly increases the risk of ROP (p=0.002) [2]. It may potentiate the effects of a given oxygen concentration as it is forced into the lungs under high pressure [16]. Agarwal and co- workers [2] reported that 52% of babies who were ventilated developed ROP. In contrast, only 36.4% of ventilated babies have ROP in the present study. This difference may be due to less number of babies we haveventilated.However on multivariate analysis by multiple logistic regression models, none of the factors were significantly associated with ROP.

The limitation of the study is that the sample size is small and may not represent all premature babies in the region. Hence, a large multicentric study is required to establish the true incidence and causal relationship of risk factors associated withROP.

Conclusion

The incidence of ROP is 8.33%. ROP group had mean birth weight of 1228gm and mean gestational age of 29.83wk. Mean gestational age at which complete vascularization of retina was evident is 39.15 week. Using a birth weight ≤ 1750g or a gestational age of ≤ 32wk, or both as criteria for inclusion in this study explains low incidence of ROP. Two third of them had stage I disease in zone III and remaining babies had stage II disease in zone II.

Incidence of ROP was inversely proportional to birth weight (p=0.004) and gestational age (p=0.001) which is statistically significant. 83.3% of babies were below ≤ 1250 gm and ≤ 30 wk of gestation age. Observation made that ROP is more common in babies ≤ 1250 gm ≤ 30 wk gestational age was also statistically significant (p=0.001). Hence, screening of babies with lower birth weight and gestational age would be more cost effective.

The present study clearly highlights the magnitude of the problem due to ROP in Indian preterm babies. The incidence is likely to increase as smaller babies survive, unless a parallel reduction in other risk factors occurs. By preventing prematurity, controlling or minimizing risk factors, and meticulous management sick babies, it may be possible to reduce the incidence of ROP. As the roles of the obstetrician, neonatologist and ophthalmologist are vital; they should work in close co-operation to reduce the incidence and morbidity associated with ROP. We suggest that indirect ophthalmoscopy should be perform edina preterm babies weighing ≤ 1750 gm and ≤ 32 wk gestational age, beginning first at 4 weeks of post natal age. Screening should be intensified in the presence of factors like oxygen administration, sepsis, apnea, ventilation RDS, hyperoxia and hypoxia.

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Clinical Study of Thyroid Orbitopathy

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Abstract

Aim: To study the age, sex, causal distribution, incidence and various modes of presentation of Thyroid Orbitopathy.

Methods: 40 patients with a diagnosis of Thyroid Orbitopathy seen between October 2016 - October 2018 were included in this study. A complete ophthalmic examination including visual acuity, ocular motility, exophthalmometry, intraocular pressure, slit lamp examination and fundoscopy was done.

Results: Among 40 patients with Thyroid Orbitopathy, 28 (70%) were females and 12 (30%) were males. Mean age of the patients was years 41.82 years (range 18-67). The female: male ratio was 2.3:1. 28 patients (70%) had Grave's hyperthyroidism, 8 patients (20%) had euthyroidism and 4 patients (10%) were hypothyroid. 80% of the patients had bilateral involvement. The most common ocular signs were eyelid retraction (80%), periorbital oedema (62.5), proptosis (60%) and chemosis (60%). Involvement of extraocular muscles in the descending order of frequency was inferior rectus (70%), medial rectus (50%), superior rectus (27.5%) and lateral rectus (15%).

Coclusion: Eyelid retraction was the most common clinical sign of Thyroid Orbitopathy in our patients. On orbital computed tomography (CT) scanning inferior rectus was the most commonly involved muscle. Lower eyelid retraction should be included in the diagnostic criteria in Asian patients.

Keywords: Thyroid Orbitopathy; Hyperthyroidis; Eyelid retraction; Periorbital oedema; computed tomography (CT) scanning

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Introduction

Thyroid eye disease (TED), also called Graves' orbitopathy (GO) is a potentially sight threatening ocular disease, mostly occurring in patients with hyperthyroidism or a history of hyperthyroidism due to Graves' disease (GD). However, it can occur in patients with euthyroid or hypothyroid chronic autoimmune thyroiditis as well and about 5-10% of patients with TED are euthyroid at presentation [1]. A prevalence of 34.7% has been reported in the in the Asian population and 28% prevalence has been reported in Indian studies among the Graves' disease patients [2,3]. Females are more commonly affected than males. However, for severe disease, this ratio reverses and severe thyroid eye disease is approximately 4 times more common in males than females [4].

The ocular changes associated with thyroid disease were first published by Graves' in 1835 and by Von Basedow in 1840. They noted swelling of tissues around the eyes in patients with hyperthyroidism but in 1786 Parry described a condition of goiter and eye protrusion [5].

The most significant pathological findings in TAO include glycosaminoglycan (GAG) deposition (accompanied by swelling resulting from the hydrophilic capacity of these macromolecules), fibrosis affecting the extraocular muscles, and adipogenesis in the orbit [6,7,8,9]. GD is an autoimmune disorder where loss of immunological

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tolerance to the thyroid-stimulating hormone receptor (TSH-R) is pivotal to the appearance of the specific antibodies [10,11].

It may occur before, with, or after the onset of overt thyroid disease and usually has a slow onset over several months. Clinical symptoms and signs are usually mild, consisting of ocular irritation with redness and tearing, stare due to lid retraction and exophthalmos, and periorbital swelling. Approximately 28% of GO cases are severe, with restricted motility leading to diplopia, exposure keratopathy, and optic neuropathy [12], 13. Management should consist of a coordinated, multidisciplinary, medical and surgical approach based on nature of the disease and its effect on the orbital and ocular structures. It is usually directed by abating or controlling the active phase of the disease, prevention of ocular and psychophysical damage, redressing ocular motor abnormality, and improving the cosmetic disfigurement 5. The current therapeutic options are corticosteroids, external beam radiation and steroid–sparing immunosuppressive agents for reducing the inflammation during active phase, and surgery for correcting the residual abnormalities secondary to fibrosis in the inactive phase of the disease. These interventions are aimed at the consequences of the disease rather than targeting its cause 14. Unfortunately, these treatments do not prevent or reverse the pathological changes in the orbital tissues [15].

Materials and Methods

This is a prospective study conducted over a period of 2 years (October 2016- October 2018). All the patients who were diagnosed with Thyroid orbitopathy at Narayana Medical College and Hospital, Nellore were included in this study. All the cases with similar presentation not proved to be Thyroid Orbitopathy and patients who did not report for the follow–up were excluded from the study. Information about age, occupation, family history, ocular symptoms and associated systemic diseases were obtained.

A comprehensive ophthalmic examination was performed in a standardized way for all patients. Best corrected visual acuity was documented by Snellen chart. Intraocular pressure (IOP) was measured by applanation tonometer in the primary position and with upward gaze. Eyelid, conjunctiva and ocular motility were assessed. Tear status was evaluated with Schirmer test and tear break-up time. We considered Schirmer < 10 mm and tear break-up time < 10 seconds as tear film dysfunction. The degree of proptosis was measured by the Hertelexophthalmometer. Proptosis was defined as the measurement of protrusion of the globe > 20 mm from the lateral orbital rim in either eye or any discrepancy in the degree of protrusion of the 2 eyes by > 2mm. Fundus examination was done for the evaluation of disc and retina.

Apart from the routine hematological examinations, the patient was subjected to radiological investigations like ultrasound or CT scan or both as per the clinical requirement to assess the lesion as well as monitor its progression or regression. Serological investigations which include Thyroid profile was also done. Once the case was confirmed to be of thyroid orbitopathy, depending on the stage of clinical presentation, the patients were reassured and observed. All patients were referred to an endocrinologist for management of thyroid dysfunction and then they were followed for a period of 6 months. The first follow up was at the 1st week and then at 1st, 3rd and 6th months.

Results

A total of 40 patients were examined. The mean age of the patients was 41.82 years (range 18-67). Of the 40 cases analyzed, female preponderance was noted (Table 1).

Table 1: Sex distribution

Sex	No. of patients	Percentage
Males	12	30%
Females	28	70%
Total	40	100%

To analyze which age groups had the highest incidence of thyroid orbitopathy, the patients were arbitrarily divided into three groups; <25, 25-50, and >50. Maximum numbers of patients were present in the 25-50 years of age group (Table 2).

Table 2: Age distribution

Age Groups	No. of patients	Percentage
<25	04	10%
25-50	28	70%
>50	08	20%

Based upon the thyroid status of the patients, they were subdivided into three groups namely: Hyperthyroid, Euthyroid and Hypothyroid. 70% of the patients were hyperthyroid followed by euthyroid in 20% and then hypothyroid in 10% of

the patients (Table 3).

Table 3: Thyroid status

Category	No. of patients	Percentage
Hyperthyroid	28	70%
Euthyroid	08	20%
Hypothyroid	04	10%

The modes of presentations were analyzed. It was found that lid retraction was the most common mode of presentation. The data regarding the various modes are as follows (Table 4).

Table 4: Modes of presentation

Modes of Presentation	Numbers	Percentage
Lid retraction	32	80%
Periorbital swelling	25	62.5%
Proptosis	24	60%
Chemosis	24	60%
Congestion	18	45%
Dry eyes	05	12.5%
Diplopia	04	10%
Motility defects	04	10%

Next the laterality of orbitopathy was analyzed. The most common presentation was found to be Bilateral than unilateral (Table 5).

Table 5: Laterality status

Laterality	Numbers	Percentage
Bilateral	32	80%
Unilateral	08	20%
Right eye	06	15%
Left eye	02	5%

The incidence of involvement of the various recti muscles was also analyzed based upon ultrasonography and computed tomographic findings. It was found that inferior rectus was the commonest muscles involved followed by medial rectus, superior rectus –LPS complex and lateral rectus in descending order (Table 6).

Table 6: Muscle involvement

Muscle involved	Numbers	Percentage
Inferior rectus	28	70%
Medial rectus	20	50%
Superior rectus	11	27.5%
Lateral rectus	06	15%

Discussion

Thyroid associated orbitopathy (TAO) is a clinical manifestation of Grave's disease (GD), and autoimmune disorder that can affect the orbital and periorbital tissue, the thyroid gland, and rarely, the pretibial skin or digits (thyroid acropachy) [16,17, 18]. Among Malaysians and Indians, a prevalence of 34.7% and 28% has been reported, respectively [3,19]. An annual incidence of 16 cases/100000 for women and 2.9 cases for men has been documented in a population in the USA [20].

The prevalence and severity have, however, been observed to have declined in recent years [21,22]. This trend might be as a result of earlier diagnosis and treatment, enhanced attention of the ophthalmologists to the link between the initial ocular manifestations and thyroid dysfunction, and changes in smoking behavior [21].

TAO poses clinical and therapeutic challenges. The severity of the disease is mild to moderate and self-limiting in a majority of patients. It may precede, coincide, or follow the systemic manifestations of GD. Ocular manifestations range from mild symptoms to more significant findings including vision loss from compressive optic neuropathy [16, 17,20].

Therefore, this study was undertaken to study the clinical manifestations in 40 patients with thyroid orbitopathy.

Age Distribution

In our study, the mean age of the patients was 41.82 years. Mean age for the females was 40 years and for the males was 46.08 years. In JurateJankauskiene et al. study [23], the mean age of the patients was 42.7 years (range from 17 to 59 years). In Savku et al. study [24], mean age of the patients was 42.3 years (range 18-82 years). Mean age of the patients in JurateJankauskiene et al. [23] and Savku et al. [24] studies was slightly similar to our study. In L. Bartalena et al. study [25], the mean age of the patients was 47.4 years. In W. M. Wiersinga et al. study [26], the mean age of the patients was 45.5 years. Mean age of the patients in L. Bartalena et al. [25] and W. M. Wiersinga et al. [26] studies was slightly higher than our study.

Sex Distribution

In our study, there were 28 females and 12 males. Female to male ratio was 2.3:1. In JurateJankauskiene et al. study [23], female to male ratio was 2:1. In W. M. Wiersinga et al. study [26], female to male ratio was 2.75:1. In JurateJankauskiene et al. [23] and W. M. Wiersinga et al. [26] studies female to male ratio

was slightly similar to our study. In Qian Li et al. study [27], which was held in China, the incidence of male and female patients was roughly equal, with a female-to-male ratio of 1.09:1. In Ali Sadeghi et al. study [28] which was conducted in Iran, the female to male ratio was 1:1.7. This was against our study.

Thyroid Status

In our study, 28 patients (70%) were hyperthyroid, 8 patients (20%) were euthyroid, and 4 patients (10%) were hypothyroid. In Ogun and Adeleye et al. study [29], 78% of the patients were hyperthyroid, 11.8% were euthyroid, and only 9.8% of the patients were hypothyroid. In M.E. Razavi et al. study 30, the majority of the patients had hyperthyroidism (82%), euthyroidism was present in 10.8% of the patients, and only 3 % of the patients were hypothyroid. Ogun and Adeleye et al. [29] and M. E. Razavi et al. [30] studies were similar to our study.

Laterality Status

In our study, 32 patients (80%) had bilateral involvement while only 8 patients (20%) had unilateral involvement. In Qian Li et al. study [27], the majority of the patients presented with bilateral disease (85.54%). The unilateral disease was present in 14.46% of the patients. In Ali SadeghiTari et al. study [28], 88.3% of the patients had bilateral involvement. Unilateral eye disease was present in only 12 patients (11.65%). Qian Li et al. [27] and Ali SadeghiTari et al. [28] studies were similar to our study.

Clinical Features

In our study, the most common signs of TED in the descending order of frequency were:Lid retraction (80%), Periorbital edema (62.5%), Proptosis (60%), Chemosis (60%), Congestion (45%), Dry eye (12.5%), Motility defects (10%), Diplopia (10%).

In Bartley et al. study [31], he indicated that eyelid retraction was the most common sign of Grave's ophthalmopathy and being present at diagnosis in 75% of the patients. This study was similar to our study.

In Nigel C S Lim et al. study [32], the commonest sign on ophthalmic examination was eyelid retraction (62.1%), followed by proptosis (61%) and conjunctival injection (55.7%). This study was similar to our study. But there was less incidence of lid retraction, and more incidence of conjunctival congestion in their study wherein in our study lid retraction and conjunctival congestion were noted in 80% and 40% of the patients respectively.

Shueh Lin Lim et al. [33] stated that the occurrence rate of upper eyelid retraction was lower compared to American and European patients. This difference may be due to a number of possible factors. Asian orbits are smaller, so any enlargement of orbital contents will more likely push the globe forward. A relatively shallower orbit and a more obtuse angle between the longitudinal axes of the orbits could combine to give rise to the higher mean values for blacks than for whites [34].

Shueh Lin Lim et al. [33] studies concluded that lower lid retraction is a common feature in Asian patients with TAO and perhaps should form a part of the diagnostic criteria in the evaluation of TAO.

Muscle Involvement

In our study, the most commonly affected muscle in the descending order of frequency was, Inferior rectus (70%), Medial rectus (50%), Superior rectus (27.5%), Lateral rectus (15%).

In Ali Sadeghi Tari et al. study [28], the commonly affected muscles in the descending order of frequency were inferior rectus (68%), medial rectus (55%), superior rectus (38%), and lateral rectus (15%). W.M. Wiersinga et al. [26] study demonstrated enlargement of inferior rectus in 60%, medial rectus in 50%, superior rectus in 40% and lateral rectus in 22%. Ali Sadeghi Tari et al. [28] and W.M. Wiersinga et al. [26] studies were similar to our study

Conclusion

Thyroid eye disease (TED) is an extremely unpleasant, painful, cosmetically distressing and occasionally sight threatening condition. It can be manifested in all thyroid states and is the most frequent extra-thyroidal manifestation of Grave's disease. Non-severe TED requires only supportive measures, such as eye ointments, sunglasses and prisms. In contrast, severe TED requires aggressive treatment, either medical (high-dose glucocorticoids, orbital radiotherapy) or surgical (orbital decompression) [35,36].

Thyroid orbitopathy is a matter of important health concern among patients with thyroid disorder. Since TED occurred with a high prevalence in all thyroid states, a close collaboration between the endocrinologists and ophthalmologists along

with timely referrals of patients with any eye complaint is deemed necessary.

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Original Article

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Study of Visual Outcome in Monocular Patients After SICS

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Abstract

Purpose: To evaluate the best corrected visual acuity (BCVA) outcomes and surgical complications in a consecutive series of functionally monocular patients who had small incision cataract surgery with IOL implantation.

Method: An interventional study done between December 2017 to May 2018 which included monocular patients who underwent SICS under local anaesthesia by same surgeon. Intraoperative and post operative complications were studied. Patients were reviewed upto 6weeks postoperatively.

Results: A total of 50 eyes of 50 monocular patients with cataract underwent SICS. Out of 50, 30 were male and 20 were females. 38 eyes had BCVA between 6/6-6/18, 10 had BCVA between 6/18-6/60, 2 had BCVA between <6/60 due to aphakia.

Conclusion: The common causes for poor vision in unoperated eye were Leucomatous corneal opacity, post traumatic pthisisbulbi,post traumatic iridocyclitis, glaucomatous optic atrophy, pseudophakic bullous keratopathy, and retinal detachment, traumatic optic neuropathy. A thorough eye examination is must before operating such cases for surgery and surgeon should be cautious while operating monocular cases.

Keywords: Intra Operative Complications; Monocular Patients; Post Operative Complications; SICS.

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Introduction

Patients were considered to be monocular if snellens best corrected visual acuity in their fellow eye (not having the surgery) was worse than 6/60 [1].

Monocular cataract patients, where one eye is untreatable for various reasons and the second eye has cataract.

Monocular patients in general fall in two categories those who, due to apprehension, wait longer than they would if they had two good eyes and those who want surgery earlier because a cataract in their only good eye creates a greater impairment. This seems to help them to sort out their thoughts [2].

Prevalence of one-eyed blindness is 0.8%.

The most common cause for monocular vision in the study group was broadly categorised into surgical and medical causes.

Surgical causes included: Pseudophakic bullous keratopathy

Medical causes included: Glaucomatous optic atrophy, retinal detachment, Leucomatous corneal opacity, Post traumatic iridocyclitis, post traumatic pthisisbulbi and traumatic optic neuropathy.

Material and Methods

This was an intervention al study conducted in department of ophthalmology, NMCHRC, Raichur.

The study was done for a period of 6months

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between December 2017 to may 2018.

A total of 50 monocular patients admitted for cataract surgery of age above 50years of either sex were included in the study.

Institutional ethical committee clearance was obtained before the start of the study.

Reason for poor vision in the unoperated eye , co-morbidities in the operated eye.

All patients underwent detailed preoperative ocular examination including clinical history and systemic examination, measurement of uncorrected and best corrected visual acuity , intraocular pressure (IOP) by Goldmann Applanation tonometry. A-scan biometry was also used to measure the power of the cornea (keratometry) and axial length of the eye, B-scan for posterior segment evaluation and using this data to determine the ideal intraocular lens power.

Detailed slit lamp biomicroscopy under maximal mydriasis was performed to assess cause of poorly dilating pupil (<6mm> like pseudoexfoliative material on the anterior capsule of lens, pupillary border, posterior synechia, type and grade of cataract, and the presence of phacodonesis or zonulolysis. Cataract was graded using "lens opacity classification system" Gonioscopy was done and the angle was graded by Shaffer's system of grading. A detailed fundus examination was conducted with slit lamp biomicroscopy using +90D and indirect ophthalmoscopy using +20 lens. All observations and demographic data were carefully recorded using a protocol sheet.

Prophylactic antibiotics drops moxifloxacin 0.5% eye drops started one day before surgery. Patients were dilated with tropicamide and phenylephrine 0.5% eye drop and non-steroidal anti-inflammatory drops flurbiprofen sodium 0.03% was used 3 times every 15 minutes to maintain the dilatation

Surgical Technique

All patients underwent small incision cataract surgery with posterior chamber intraocular lens implantation by experienced surgeon.

After peri-bulbar block with 5 ml of with 2% lignocaine with adrenaline (1: 20, 0000) with 150 units/ml of hyaluronidase. Povidine-iodine 5% was instilled into the conjunctival sac. For SICS a fornix base conjunctival flap was made, scleral incision was made with bard parker knife with 15 no. Blade temporally or supero-temporally and sclerocorneal tunnel was constructed with crescent. Continuous curvilinear capsulorhexis (CCC) aimed at 5mm to 5.5 mm was done using the needle cystitome.

Small pupils were managed with multiple sphincterotomies, viscomydriasis. A thorough hydrodissection was performed to separate cortex from nucleus. Nucleus was delivered by visco expression. Irrigation and aspiration was done with Simcoe's two way irrigation and aspiration cannula. Rigid, single piece, biconvex, polymethyl meth acrylate posterior chamber intraocular lens (IOLs) with optic diameter of 5.25 mm was implanted in bag.

Intraoperative and post operative complications were noted

Post-operatively, patients were put on topical antibiotics and steroids tapered over 4-6 weeks depending upon the post operative inflammation. Patients were followed on the post-operative day 1, day 7 and day 14 and at weekly intervals for 6weeks to evaluatecorneal edema, intraocular pressure spikes, presence of intraocular inflammation and decentration/tilt of intra ocular lens. Postoperative uncorrected visual acuity was recorded every week and best corrected visual acuity was recorded at 6th week.

Results

A total of 50 eyes of 50 monocular patients underwent small incision cataract surgery by experienced surgeon after pharmacologically dilating with tropicamide and phenylephrine 0.5% eye drop.

Of 50 patients, 20 (40%) were females and 30 (60%) were males. The ages of 50 patients in this study was between 50 and 70 years with a mean age group of 66.8years. Out of these 28 (56%) were in 50-60 year age group and 22 (44%) were in 60-70 year age group.

Reason for poor vision in the unoperatedeye, co-morbidities in the operated eye, intraoperative and postoperative complications were recorded.

Out of 50 monocular patients 19 (38%) patients had Leucomatous corneal opacity, 7 (14%) patients had Pseudophakic bullous keratopathy, 9 (18%) patients had Glaucomatous optic atrophy, 4 (8%) had Iridocyclitis, 8 (16%) patients had post traumatic pthisisbulbi, 1 (2%) patient had traumatic optic neuropathy, and 2 (4%) retinal detachment. Comorbidities like diabetic retinopathy and age related macular degeneration in the operated eye were not included in our study.

Mean intraocular pressure (IOP) was 18.23 ± 2.10

mm Hg.

Pre operative visual acuity and grading of cataract according lens opacification classification system iii was recorded, shown in table 1.

Table1: Grading of cataract

Grade of cataract	Pre operative visual acuity	Number of patients'n'
G I NS with central thick PSC	6/18	10
G II NS with PSC	6/36	12
G III NS	6/60	28
Total		50

G- Grade of cataract; NS- Nuclear sclerosis; PSC- Posterior subcapsular cataract.

Out of 50 eyes 04 (8%) eyes showed some evidence of pigment dispersion mainly on the anterior surface of the lens and back of cornea. None of the eyes showed frank subluxation of lens.

All patients underwent cataract surgery using SICS technique. Surgical complications are listed in (Table 2). 4 (8%)cases required sphincterotomy to facilitate capsularhexis and nucleus delivery. Zonular dialysis seen in 1 (2%) cases, posterior capsular tear with vitreous loss seen in 1 (2%) due to difficulty in surgical maneuvers, iris trauma occurred in 4 cases (8%).

Table 2: Intra op complications table

Complications	Number of patients 'n'(%)
Zonular dialysis	1 (2%)
PCR with vitreous loss	1 (2%)
Poorly dilating pupil	4 (8%)

PCR: Posterior capsule rupture

Patients were followed on the post-operative day 1, day 7, day 14 and at weekly intervals for 6weeks to evaluate intraocular pressure spikes, intraocular inflammation, decentration/tilt of intraocular lens and corneal odema.

Post-operative hazy cornea (corneal odema) was seen in 6 (12%) cases. Anterior chamber reaction in 4 (8%)cases, irregular pupil seen in 4 (8%)cases (Table 3).

Table 3: Post op complications

Complications	Number of patients'n'(%)
Corneal edema	6(12%)
AC reaction	4(8%)
Irregular pupil	4(8%)

AC- Anterior chamber

Final visual acuity was recorded after 6 weeks of surgery (Table 4). At the end of 6 weeks, 38 (76%) cases had visual acuity between 6/6-6/18, 10 (20%) patients had visual acuity between 6/18-6/60 and 2 (4%) patients had visual acuity less than 6/60 rendered aphakia due to zonular dialysis and posterior capsular rent with vitreous loss.

Table 4: Final visual acuity

Visual acuity	Number of patients 'n'(%)
6/6-6/18	38 (76%)
6/18-6/60	10 (20%)
<6/60	02 (4%)
Total	50 (100%)

Discussion

As cataract surgery becomes more accessible and patient outcomes continue to improve, the decision of when to operate on cataract in monocular patients is not always clear [3].

This debate is especially significant in monocular patients because there is an increased risk for the same degree of benefit after cataract extraction.

These patients are often very symptomatic and want the cataract out of the good eye [4]. Their monocular status confers a greater risk for reduced vision as a result of surgical complications.

The safety of surgical procedure and experience of the surgeon explain the small number of complications.

This study highlights thorough pre-operative consideration and potentially life changing outcomes that an ophthalmologist can make [3].

Patient counselling is critical because despite a perfect surgical technique infection, retinal detacment and other post operative complications can still occur [5].

Causes of monocular vision in this study included, 19 (38%) patients had Leucomatous corneal opacity, 7 (14%) patients had Pseudophakic bullous keratopathy, 9 (18%) patients had Glaucomatous optic atrophy, 4 (8%) had Iridocyclitis, 8 (16%) patients had post traumatic pthisisbulbi, 1 (2%) patient had traumatic optic neuropathy, and 2 (4%) retinal detachment.

Certain eyes are at a higher risk of complication during cataract surgery. Operations on such 'high-risk' eyes are also more likely to yield a poor visual outcome (defined as best corrected vision less than 6/60 after surgery).

Learning to recognise when eyes are at greater risk, and acting accordingly, will help you to avoid

complications. Even so, before the operation takes place, it is good practice to explain to such patients that a poor outcome is a possibility. This makes these patients' expectations more realistic and improves postoperative compliance and follow-up.

In the present study, most frequent problem encountered was a poorly dilating pupil of not more than 6 mm in spite of use of standard mydriatic drops. We resorted to sphincterotomy, viscomydriasis. Sphinterotomy have the disadvantage of causing post-operative distorted pupil, which may even lead to the pupillary capture.

Intra operative complications encountered were Zonular dialysis in 1 (2%) cases, posterior capsular tear with vitreous loss in 1 (2%) cases due to difficulty in surgical maneuvers, iris trauma occurred in 4 (8%) cases. Post-operative hazy cornea (corneal odema) was seen in 06 (12%) cases. Anterior chamber reaction in 4 (8%) cases, irregular pupil seen in 4 (8%) cases. After 6 weeks 38 (76%) cases had visual acuity between 6/6-6/18, 10 (20%) patients had visual acuity between 6/18-6/60 and 2 (4%) patients had visual acuity less than 6/60 rendered aphakia due to zonular dialysis and posterior capsular rent with vitreous loss.

We did not encounter complications like decentered IOL, retained cortical matter, postop hyphema as seen in other studies.

In a retrospective observational study by De Monchy and C Rohart6 conducted for a period of 4years on 50 monocular patients. Preoperative median BCVA in the operated eye was 6/36.

The final BCVA reflecting efficacy of cataract surgery improved in 50% of patients.

In our study preoperative median BCVA in the operated eye was 6/60 and the final BCVA after cataract surgery improved to 76%.

In a study by Trotter W, Miller KM [7] conducted on 100 monocular patients had median preoperative BCVA of 6/18 in the operated eye and the final BCVA improved by 3 lines.

In our study the final BCVA after cataract surgery improved by 4 lines.

Conclusion

This study serves as the reminder of the importance of carefully evaluating cataracts in monocular patients before making the decisions to operate but that delaying surgery unnecessarily might increase the risk for complications associated with dense cataract.

Avoiding unnecessary complications in our patient was especially imperative because this surgery was the only measure left for visual restoration.

This study highlights pre operative considerations and potentially life changing outcomes that we as opthalmologist can make.

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Original Article

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Prevalence of Ocular Morbidity in School Going Children in Solapur District of Maharashtra

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Abstract

Background: Majority (80%) of all visual impairment globally is considered to be avoidable or reversible if identified early in life. Children are the most venerable group as they do not identify / notify the early signs of visual impairment.

Aims and Objective: To estimate prevalence of ocular morbidity in School going children in Solapur district of Maharashtra.

Methods: This cross-sectional study was conducted in 10 selected schools, 4 urban and 6 rural schools. Detailed ophthalmic examination was done by an ophthalmologist. A total of 3212 school going children, 1664 boys and 1578 girls, were examined between August 2017 and February 2018.

Results: A total of 436 children with different ocular morbidities were detected in the study, revealing the prevalence of ocular morbidity equal to 13.57%. The overall prevalence of ocular morbidity in boys and girls was 14.18 % and 12.92%. The overall prevalence of ocular morbidity was not significantly different in boys and girls ($Z = 1.05$, $p=0.30$). The most common ocular morbidity was refractive errors (8.75%), followed by miscellaneous conditions which included infectious or allergic conditions like conjunctivitis, blepharities etc.

Conclusion: The study has concluded that the overall prevalence of ocular morbidity was 13.57%. The prevalence of refractive errors was significantly more in urban children than in rural children. Similarly refractive errors were significantly more in older children (> 11) years than in children below the age of 11 years.

Keywords: Ocular Morbidity; Prevalence; School Going Children; Refractive Errors.

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Introduction

Approximately 1.3 billion people, estimated globally, are living with some form of vision impairment, cataract, glaucoma, corneal opacity trachoma and macular degeneration. The reasons of vision impairment vary considerably across countries among children. With effective available intervention majority (80%) of all visual impairment globally are considered to be avoidable or reversible if identified early in life. Over the years, WHO has developed and implemented various tools to assess the presence of ocular morbidity and provision of eye care services in the country [1].

In India it is predicted that around 62.6 million people were having visual impairment in the year 2010 and this number is rising significantly and is likely to reach 139 million by 2020 [2,3].

Visual Impairment in children and the young

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has a lot of social and economical implications in the future. Children in schools are affected by vision problems such as refractive errors, vitamin A deficiency, squint and eye infections. The fact that 30% of Indian blindness has lost vision before the age of 20 years, the importance of early detection and treatment of ocular morbidity and visual impairment in young children is obvious [4]. Children are unaware of the symptoms and complications of the impaired vision or are scare of being teased form their friends hence they may not complain of defective vision and try to adjust by sitting in the front, holding the book close to the eyes, squeezing the eyes.

The earliest signs of refractive errors are strainful eyes with or without reddening in the evening, with watering and headache. The complaints of these children to the parents were unnoticed due to lack of awareness in the rural areas [5].

School children form a stable population, easily accessible and school is the best place to provide health education to the children and intern the community. Early identification and proper guidance on visual impairment will help these children in a long way to prevent the preventable causes of blindness. Hence the present study was undertaken in the school children to assess the prevalence of ocular morbidity.

Materials and methods

Type of study: Cross sectional.

Study setting: Ten selected schools in Solapur district, 4 urban and 6 rural.

Study period: August 2017 to February 2018.

This cross-sectional study was conducted by the department of Ophthalmology and Community Medicine of Ashwini Rural Medical College Hospital and Research Centre, Solapur. Ten schools were selected by purposive sampling, due to operational feasibility, for this study. A team of Ophthalmologists, Community Medicine teacher, Ophthalmic technicians, data entry operators etc visited every selected schools after obtaining due permission from the school authorities. The entire school going children from kinder garden to tenth class, present in the school were examined for any of the ocular morbidity. Multiple visits were paid to the schools to examine most of the children from each school. A pre-defined proforma was used to record the data of each child. If child was having any of the ocular morbidity, then the child was treated on the spot or he was referred to medical college hospital for further management. Data was analyzed using excel. Chi square test was wherever necessary.

Results

A total of 10 selected schools were included in the study. Out of that 6 were from rural area and 4 were from urban area. Operational feasibility was the purpose for selecting these schools. Table 1 shows the age and gender wise distribution of study population. There were 1664 boys and 1578 girls included in the study. Maximum number of children was in the age group of 11-13 years, 616 (19.18%), followed by the age group of 13-15 years, 567 (17.65%). A total of 1664 boys and 1548 girls were included in the study. Then mean of boys was 10.91 ± 3.39 and for girls 10.89 ± 3.37. There was no significant difference in the mean ages of boys and girls. ($Z = 0.17$, $p = 0.86$).

Table 1: Age and gender wise distribution of study population

Sr	Age	Boys	Percentage	Girls	Percentage	Total	
1	5-7	289	17.37	265	17.12	554	17.25
2	7-9	268	16.11	248	16.02	516	16.06
3	9-11	265	15.93	249	16.09	514	16.00
4	11-13	315	18.93	301	19.44	616	19.18
5	13-15	292	17.55	275	17.76	567	17.65
6	> 15	235	14.12	210	13.57	445	13.85
	Total	1664	100.00	1548	100.00	3212	100.00

Table 2: Urban – rural wise distribution of study population

Sr	Location of school	Boys	Percentage	Girls	Percentage	Total
1	Rural	851	52.08	783	47.92	1634
2	Urban	813	51.52	765	48.48	1578
		1664	51.81	1548	48.19	3212

A total of 1634 children in 6 rural schools and 1578 children in 4 urban schools were examined in this study. Table 2 shows the location wise distribution of examined school going children.

Table 3 shows the prevalence of different ocular morbidities in the study population. A total of 436 children with different ocular morbidities were detected in the study, revealing the prevalence of ocular morbidity equal to 13.57%. The overall prevalence of ocular morbidity in boys and girls was 14.18% and 12.92%. The overall prevalence of ocular morbidity was not significantly different in boys and girls (Z = 1.05, p=0.30). Similarly, there was no significant difference in the prevalence of any of the ocular morbidity in boys and girls.

comparatively less ranging from 0.06 % to 1.12%.

Table 4 shows school location wise prevalence of ocular morbidities. The study has observed that the prevalence of refractive errors in urban schools was significantly more than that in rural schools (p=0.02). There was no significant difference in the rest of the morbidities in urban and rural areas.

Table 5 shows the prevalence of ocular morbidities in the age group of ≤ 11 years and > 11 years. The prevalence of refractive errors was significantly more in older children (p=0.0001). The prevalence of developmental cataract was significantly more in the age group of ≤ 11 years than that in the age group of > 11 years (p = 0.0386). Similarly prevalence of convergence inefficiency

Table 3: Gender wise Prevalence of ocular morbidity in the study population

Sr	Ocular condition	Boys (N=1664)		Girls (N=1548)		Total (N=3212)		Chi square	p value
		Affected	Prevalence in%	Affected	Prevalence in%	Affected	Prevalence in%		
1	Refractive error	156	9.38	125	8.07	281	8.75	1.70	0.19
2	Vitamin A deficiency	5	0.30	4	0.26	9	0.28	0.05	0.82
3	Strabismus	1	0.06	1	0.06	2	0.06	0.00	0.96
4	Corneal opacity	2	0.12	3	0.19	5	0.16	0.28	0.60
5	Developmental cataract	7	0.42	4	0.26	11	0.34	0.62	0.43
6	Convergence inefficiency	21	1.26	15	0.97	36	1.12	0.62	0.43
7	Squint with amblyopia	11	0.66	12	0.78	23	0.72	0.15	0.70
8	Squint without Amblyopia	2	0.12	1	0.06	3	0.09	0.27	0.61
9	Miscellaneous	31	1.86	35	2.26	66	2.05	0.63	0.43

Table 4: Location wise prevalence of ocular morbidity

Sr	Ocular condition	Rural (N=1634)		Urban (N=1578)		Total (N=3212)		Chi square	p value
		Affected	Prevalence in%	Affected	Prevalence in%	Affected	Prevalence in%		
1	Refractive error	124	7.59	157	9.95	281	8.75	5.60	0.02
2	Vitamin A deficiency	6	0.37	3	0.19	9	0.28	0.80	0.37
3	Strabismus	1	0.06	1	0.06	2	0.06	0.00	0.96
4	Corneal opacity	1	0.06	4	0.25	5	0.16	2.03	0.15
5	Developmental cataract	5	0.31	6	0.38	11	0.34	0.18	0.67
6	Convergence inefficiency	17	1.04	19	1.20	36	1.12	0.31	0.58
7	Squint with amblyopia	13	0.80	10	0.63	23	0.72	0.21	0.65
8	Squint without Amblyopia	1	0.06	2	0.13	3	0.09	0.41	0.52
9	Miscellaneous	27	1.65	39	2.47	66	2.05	3.20	0.07

The most common ocular morbidity was refractive errors (8.75 %), followed by miscellaneous conditions which included infectious or allergic conditions like conjunctivitis, blepharities etc. Prevalence of rest of the morbidities was

was significantly more in in the age group of ≤ 11 years than that in the age group of > 11 years (p =0.0002). Prevalence of any of the other ocular morbidity was not significantly different in these two age groups.

Table 5: Age wise prevalence of ocular morbidity

Sr	Ocular condition	Age ≤ 11 (N=1584)		Age > 11 (N=1628)		Total (N=3212)		Chi square	p value
		Affected	Prevalence in%	Affected	Prevalence in%	Affected	Prevalence in%		
1	Refractive error	112	7.07	169	10.38	281	8.75	14.44	0.0001
2	Vitamin A deficiency	7	0.44	2	0.12	9	0.28	2.65	0.1035
3	Strabismus	0	0.00	2	0.12	2	0.06	2.06	0.1515
4	Corneal opacity	2	0.13	3	0.18	5	0.16	0.23	0.6325
5	Developmental cataract	9	0.57	2	0.12	11	0.34	4.28	0.0386
6	Convergence inefficiency	7	0.44	29	1.78	36	1.12	14.22	0.0002
7	Squint with amblyopia	11	0.69	12	0.74	23	0.72	0.08	0.7831
8	Squint without Amblyopia	2	0.13	1	0.06	3	0.09	0.31	0.5796
9	Miscellaneous	35	2.21	31	1.90	66	2.05	0.15	0.7002

Discussion

This cross-sectional study was planned in 10 schools, 4 urban and 6 rural, to estimate the prevalence of ocular morbidities in school going children. The study has observed that the overall prevalence of ocular morbidity was 13.57%.

Nepal et al. have reported a comparable prevalence of 11% in a study conducted at Kathmandu [6]. Prajapati et al. have reported a 13% prevalence in a study conducted in Gandhinagar [4]. Another study conducted by Nirmalan et al., the Kariapatti pediatric eye evaluation project, has reported a prevalence of 13.6% [7]. All these results were comparable with our study.

A study conducted by Kumar et al. has reported the prevalence of ocular morbidity as 22.7% [8]. A study conducted by Veer Singh et al. has reported the prevalence as 28.34% in western Uttar Pradesh [9]. Another study conducted by Gupta et al. in shimla has reported the prevalence equal to 31.6% [10]. Meriton Stanly A et al. has reported the prevalence equal to 22.3% [11]. Another study conducted by Chaturvedi and Aggarwal has reported it as 40% [12]. These studies have reported a higher prevalence than reported by this study. The difference may be due to different socio-demographic characteristics of the study population, seasonal variations in the ocular conditions etc.

The present study has reported that there was no significant gender wise difference in the ocular morbidities. The finding were comparable with the findings of Gupta et al. [10], who reported marginal difference in the prevalence of ocular diseases among males and females (32.5 and 30.6%) and Sehgal et al. (males 46.1% and females 48.3%) [13].

However, a study conducted by Khurana et al. has reported significantly higher prevalence of ocular morbidities in females (73.5%) as compared to males (49.4%) in Haryana [14]. In that study, higher prevalence of infectious diseases like trachoma, conjunctivitis amongst females was attributable to increased use of common ocular cosmetic material.

Conclusion

The present study has revealed that the prevalence of different ocular morbidities was 13.57%. The most common ocular morbidity was refractive errors followed by miscellaneous infectious and allergic conditions like conjunctivitis, blepharities etc. There was no significant difference in the ocular morbidity amongst boys and girls. However, refractive errors were significantly more in urban children than in rural children. Similarly refractive errors were significantly more in older children (> 11) years than in children below the age of 11 years.

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Original Article

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Relationship between Amount of Energy Used and Rise in Iop in Cases of Neodymium: Yttrium-Aluminum-Garnet Laser Posterior Capsulotomy

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Abstract

Objective: To find the relationship between the amount of energy used and significant rise in IOP (>5mmHg) after Nd:YAG laser posterior capsulotomy.

Materials and Methods: 100 pseudophakic eyes of adults age 30-70 yrs of either sex having PCO are included. Amount of laser energy (milli joules) used in each case noted, IOP was measured just before the procedure and at 1,4,24 hours after procedure in each case. Total energy used is grouped into low (<20mJ), intermediate (20-40mJ), high (>40mJ). Change of IOP at 3 post laser recording times categorized into 1) No change 2) Rise of 1-5mmHg 3) >5 mm Hg.

Results: 100 pseudophakic eyes, 61 males and 39 females. Number of patients in low, intermediate, high energy group were 43,45,12 respectively and significant rise in IOP (>5mm Hg) noted are 6/43 (13.9%), 12/45 (26.6%), 8/12 (66%) respectively. Significant rise in IOP noted at 1,4,24 hours post laser application are 7/26 (26.9%), 15/26 (57.6%), 4/26 (15.3%) respectively.

Conclusion: There is a directly proportionate relationship between the amount of laser energy used and IOP rise.

Keywords: Neodymium; Yttrium-Aluminum-Garnet Laser; Intraocular Pressure; Cataract.

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Introduction

Cataract is defined as any opacity in the crystalline lens of the eye that may be congenital or acquired that impairs vision. It is by far the most common curable cause of low vision and blindness worldwide. Cataract forms the major cause of blindness in India accounting for about 62.6% [1] amongst all the causes of blindness. Cataract extraction is the most frequently performed surgical procedure in patients over 60 years of age.

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The development of cataract surgery has led the world from the uncertain time of couching of lens to the ICCE, ECCE. The visual results of cataract surgery are at present very good and serious complications such as endophthalmitis and suprachoroidal haemorrhage are fortunately very rare, affecting less than 1 in 1000 patients in many series. In ECCE and phacoemulsification due to preservation of posterior capsule of lens, allows placement of posterior chamber IOL and prevent prolapse of vitreous into AC. It also reduces the risk of several complications, including vitreous loss and subsequent vitreous detachment, cystoid macular edema and retinal detachment. ECCE with posterior chamber IOL implantation is the common ocular surgery performed in all the eye care centers. Sometimes residual lens epithelial cells proliferate and migrate to form a dark cloud in front of visual field known as posterior capsule opacification. PCO otherwise also known as secondary cataract or after cataract is a frequent

and late complication of extracapsular cataract extraction (ECCE) either small incision cataract surgery (SICS) or phacoemulsification with or without IOL implantation as mentioned by Pandey et al. [2] PCO develops months to years after cataract surgery. Incidence of PCO varies from 20.7 % [3] at 2 years & 28.5% [3] at 5 years after cataract surgery. Schaumberg et al metanalysis of published articles showed that incidence of PCO during 5 years postoperative period is 25% [4]. PCO can lead to clinically significant reduction in visual acuity and impaired contrast sensitivity.

Management of PCO is surgical before the era of Nd:YAG laser posterior capsulotomy. PCO was treated with primary or secondary surgical capsulotomy and surgical polishing of posterior capsule [5], but because of complications associated with above procedure,YAG capsulotomy became the procedure of choice. Nd:YAG laser posterior capsulotomy is an ophthalmic procedure aimed at removing the opacified capsule from pupillary area in aphakic/pseudophakic eyes. The procedure is generally non-invasive, harmless and improvement of vision is marked.This laser works by photo-disruptive properties. Common complications include IOP rise, hyphema, cystoid macular edema, corneal haze, uveitis, IOL pits, retinal detachment. So it is common practice by the ophthalmologists to prescribe anti-glaucoma medications to lower IOP before and after procedure.

It has been postulated that the increase in IOP post YAG capsulotomy is due to reduced outflow facility because of blockade of trabecular meshwork by the inflammatory cells and capsular debris6,vitreous particles floating in the anterior chamber. The total energy used is an important factor leading to raised IOP after laser capsulotomy.Therefore, it was decided to conduct study on this important but less attended aspect. The objective of our study is to establish the relationship between total energy used and IOP rise by comparing the relative frequency of raised IOP into low, intermediate and high energy groups. We also determined the post YAG time interval in which this rise of IOP affects the patient population maximally.

Materials & Methods

This cross sectional observational study was conducted over a period of 12 months (August 2017 -August 2018) on 100 patients presenting with PCO after cataract surgery who attended ophthalmology OPD at Narayana Medical College and Hospital, Nellore.

Inclusion Criteria

All adult cases 30-70 yrs. of either sex having PCO with vision < 6/24 and giving informed consent are included in the study

Exclusion Criteria

- Age <30 years
- PCO associated with corneal scars, irregularities and oedema that interferes with target visualization.
- PCO associated with active intraocular inflammation.
- Patients having glaucoma/on glaucoma medication/ had trabeculectomy
- Patients on topical/systemic steroid therapy
- Postoperative cataract surgery patients of <8 weeks

Data Collection

- Name, age, sex and address of all the patients were noted.
- Local examination was done as follows:

a. Visual acuity – BCVA was noted from Snellen's chart

b. Slit lamp examination –Anterior segment was examined. PCO was examined and type of opacity is noted

c. Fundus examination – Dilated fundus examination done by slit lamp biomicroscopy

d. Tonometry – Preoperative baseline intraocular pressure was taken by Applanation tonometer, at least 1 hour before the procedure.

Technique

All patients with PCO and vision <6/24 were subjected to Nd:YAG laser capsulotomy. The procedure to be done & complications associated with it were explained to the patients and oral consent was taken. All capsulotomies were done using APPA YAG LASER machine at single burst per pulse and amount of energy used depended on thickness of PCO. The aiming beam was focused on posterior capsule. A cruciate opening in capsule begins superiorly at 12 o'clock position progressing towards 6 o'clock cut across at 3 o'clock and 9 o'clock positions. Any residual tags or freely floating fragments are cleared.

Postoperative Care

All patients were examined post laser. Total amount of laser energy used in each case and IOP at 1st hr, 4th hr and 24th hour after procedure recorded in each case. Total energy used is grouped into low (20mJ), intermediate (20-40 mJ), high (>40mJ). Change in IOP at 3 post laser recording times was categorised into 1) no change of IOP, 2) rise of (1-5mm Hg) 3) significant change (>5 mm Hg rise in IOP). No medication was administered until 24 hrs of procedure. For all patients, topical steroids (1% prednisolone) administered 4-6 times/ day and is tapered over 1-2 weeks. Patients with significant rise in IOP (>5mm Hg) treated with topical Brimonidine 0.2% eye drops BD for 1 week.

Results

100 pseudophakic eyes were studied, 61 males and 39 females. 62% were right eye and 38% left eye. Age ranged from 30-70 years. Maximum patients are seen in the age range of 51-60 (42%) followed by 61-70 (37%). Most common type of PCO is membranous type (72%). Number of patients receiving low, intermediate, high energy were 43, 45,12 respectively and significant rise in IOP (>5mm Hg) noted in 6/43 (13.9%), 14/45 (31%), 8/12 (66%) respectively. Significant rise in IOP (>5mm Hg) noted at 1,4,24 hrs post laser application are 10/28 (35.7%), 14/28 (50%), 4/28 (14.3%) respectively. A total of hundred eyes were studied, males were 61 (61%) and females were 39 (39%) (Tables 1-3).

Table 1: Age distribution

Age group in yrs.	No.of patients = 100	Percentage
30-40	4	4%
41-50	17	17%
51-60	42	42%
61-70	37	37%

Table 2: Laterality distribution

Eye	No.of patients = 100	Percentage
Right eye	62	62%
Left eye	38	38%
Total	100	100%

Table 3: Morphological type of PCO

PCO morphology	No.of patients = 100	Percentage
Membranous	72	72%
Elschnig's pearls	17	17%
Soemmering's ring	11	11%

In the present study, duration of onset of symptoms of PCO is more common between 1-2 years (42%) after surgery. The earlier is after 6 months and longest is > 4 years after surgery. In the present study IOL pitting was seen in 8 (8%) cases, 4 (4%) cases developed iritis, 2 (2%) cases developed CME, corneal burns and hyphema seen in 1 (1%) patient each (Table 4).

Table 4: Total energy used and IOP rise

Energy Groups	Total patients	No change in IOP	Rise of 1-5 mmHg	Rise of IOP >5 mmHg
Up to 20 mJ	43	11 (25.5%)	26 (60.4%)	6 (13.9%)
20 – 40 mJ	45	3 (7%)	28 (62%)	14 (31%)
>40 mJ	12	1 (9%)	3 (25%)	8 (66%)

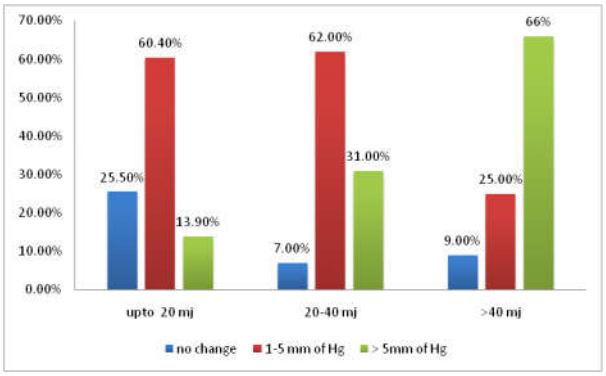

Fig. 1: Showing different categories of IOP responses in low, intermediate, high energy groups.

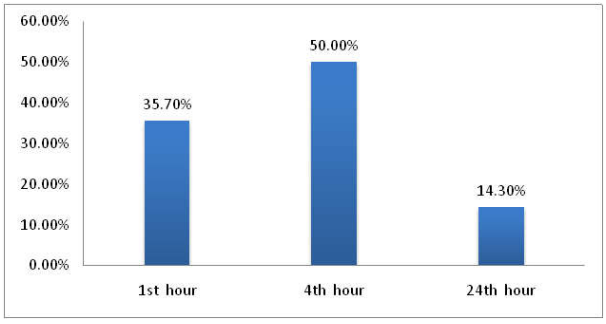

Fig. 2: Showing split of 26 patients with significant rise of IOP at 1,4, 24 hrs post laser.

Discussion

PCO is the most common delayed complication of cataract surgery. The incidence of PCO was reported to be 20.7% [3] at 2 years and 28.5% [3] at 5 years after cataract surgery. The standard treatment for PCO is Nd:YAG laser posterior capsulotomy. The visual outcome after Nd: YAG laser capsulotomy is significantly high. Even though the procedure is quiet safe it is associated

with complications like transient IOP rise, damage to IOL, cystoid macular oedema,retinal detachment, vitreous in anterior segment, anterior uveitis etc. Most common complication is rise in IOP and IOL pitting being the second most complication observed.

In our study 79% patients were in 50-70 years age group. This was the commonest age group who undergo cataract surgery. The minimum age was 31 years and maximum age was 70 years.

In the study conducted by Manav deep Singh et al. [7], the mean age of patients was 58 years. In the study conducted by Wajeeha Rasool et al. [8], the mean age of the patients was 66 years ,with a range of 50-85 years. In Ajite KO et al. [9], most of the patients were in the 41-80 years age range. This is perhaps the age at which patients with age related cataract presents to the ophthalmologists due to visual problems.

In the present study we had 61% males and 39% females. Male: female ratio is 1.56:1. In the study conducted by MY Khan et al. [10], 39 (67.2%) were males and 19 (32.8%) were females. In Wajeeha Rasool et al. [8], study sex incidence was 118 (59%) males and 82 (41%) females. Mirza Shafiq et al. [11], found a male preponderance in PCO in which males were 350 (70%) and females were 150 (30%). All the above studies correlate with our study of significant male preponderance. This may be related to predominant male population in our country and female population less commonly present to the hospital for their reduced vision and less commonly undergo cataract surgery.

In the present study most number of patients with PCO presented between 1-2 years after cataract surgery. The earliest onset is after 6 months and longest is 4 years after surgery.

In the study conducted by Jayne Ge et al. [12], the average time between cataract extraction and capsulotomy was 24 months. In Mirza Shafiq et al. [11], study the time period between surgery and YAG laser was between 6 months to 12 years. In prospective studies conducted by Ajite KO et al. [9]. and Lal Muhammad et al. [13], diagnosis of PCO is in between 3-12 months post surgery.This variation may be a result of the surgical technique employed by the surgeons or nature of the intraocular lenses implanted promoting the development of PCO.

In the present study most common type of PCO was found to be membranous type (76%), Elschnig's pearls constitute 17 (17%) and Soemmering's ring is present in 11 (11%) patients.

In the study conducted by Shankar Ganvit et al. [14], membranous PCO constitutes 57% of all types. In Mirza Shafiq et al. [11], study membranous PCO was found in 260 (51%) patients. However in Niharika K. Shetty et al. [1], study Elschnig's pearls constitute 74.28% of total PCO morphology and study of Ronald Holweger et al. [15], showed 61.38% patients has Elschnig's type PCO.

Rise of IOP is the most common complication after Nd:YAG laser capsulotomy. It has been postulated that the increase in IOP post YAG capsulotomy is due to reduced outflow facility because of blockade of trabecular meshwork by the inflammatory cells, capsular debris [6] and vitreous particles floating in the anterior chamber [6].

Risk Factors that Affect Iop after Laser Capsulotomy

1. Size of capsulotomy – small ones has small IOP rise
2. High total energy used – more IOP rise due to laser induced shock waves which damage trabecular meshwork
3. Capsular bag fixation IOLs– which provide barrier effect to debris produced by capsulotomy have minimal IOP rise
4. Patient dependant risk factors [16,17]:

   a. Aphakia

   b. Glaucoma

   c. High myopia

   d. Vitreoretinal disease

   All above are associated with higher IOP rise.

In our study amount of laser energy used was categorised into 3 groups i.e, upto 20 mJ (low), 20-40 mJ (medium) and >40 mJ (high). Significant rise of IOP (>5mm Hg) was seen in 13.9% in low energy group, 31% in medium energy group and in 66% in high energy group. Thus we found a proportionately rising rate of significant IOP rise (>5 mm Hg) in high energy groups when compared to lower energy ones which is statistically significant (p value = 0.001).

Similar study but with different energy values by Qamar Farooq et al. [18], shows that significant rise of IOP was noted in 30 out of 90 patients, 50% of them (15 out of 30 patients) belong to high energy group. In Muhammad Waseem and Haseeb Ahmed Khan et al. [19], study the mean rise in IOP value was 3.83 ± 1.84 mm Hg in Low energy category (<50 mJ) where as in 'High energy' category the mean rise in IOP value was 5.51 ± 1.58 mmHg which is statistically significant (p > 0.001).

In Niharika K. Shetty [1], Sriya Sridhar et al. [1] studies patients were exposed to total of 2-14 mJ energy & more rise in IOP was seen in patients receiving 11-14 mJ energy. In Richter CU et al. [16], while using > 200 mJ they noticed a rise of IOP (> 10 mm Hg) in their 67% of cases, 38% of which were having > 40 mm Hg rise in IOP. According to Bhargava R et al. [20], rise in IOP was seen in 12.6% of the patients in which average energy used was 57.8 mJ when compared to no rise of IOP in patients receiving 42.3 mJ of energy. Channel and Beckman et al. [3], study showed that higher IOP rise was associated with larger capsulotomies and increased laser energy use during YAG procedures

In the present study, out of 100 patients significant rise in IOP (>5 mm Hg) is seen in 28 patients. Out of these 28 patients, 10 (35.7%) showed IOP rise at 1st hour, 14 (50%) showed IOP rise at 4th hour and 4 (14.3%) patients at 24th hour. In 85.7% of patients IOP surge is seen in first 4 hours.

In Qamar Farooq et al. [18] study rise in IOP is seen in 63.3% patients in 1st hr, 33.3% at 4th hr, 3.3% at 24th hr after the procedure. Thus IOP surge is noted within first 4 hours in 97% of patients of this study. Similar study by Richter CU et al. [16], showed that 13 mm Hg IOP rise seen in first 3 hrs, 5 mm Hg in first 24 hrs and IOP returned to baseline within 1 week. In Manavsingh, Nidhisharma et al. [21], study rise of IOP from baseline at 1,3,5 hours post laser come down to insignificant levels at 24 hours. In Channell MM, Beckman et al. [3] study all eyes in which IOP increased > 5 mm Hg showed the rise within the first 48 hrs.

Even though laser posterior capsulotomy is very safe and non-invasive procedure several complications have been reported. In the present study IOL pitting was observed in 8 (8%) cases, which was not visually significant and didn't produce any glare or image distortion. 4 (4%) developed iritis which was treated with topical steroids and cycloplegics. 2 (2%) cases developed CME ,which was treated with topical 1% prednisolone acetate and NSAIDS. Corneal burns and hyphema is seen in 1 (1%) patient each.

Conclusion

PCO is the most common complication following cataract surgery which can be safely treated by Nd:YAG laser posterior capsulotomy as an OPD procedure. The common complication encountered after Nd:YAG laser capsulotomy is transient rise in IOP which returns to baseline within 48 hours in most patients. Correlation exists between total energy used and IOP rise. Some rise of IOP does occur in most of the cases, but those receiving higher amount of laser energy develop significant IOP elevations. This pressure rise is seen in first 4 hours in most of the cases. Minimal total energy possible should be used to perform laser capsulotomy and those requiring higher energy are worth monitoring.

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Original Article

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Comparitive Analysis of Phacoemulsification with Rigid IOL and SICS in Camp Patients

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Abstract

Objective: To make a comparative analysis of clear corneal phacoemulsification (PHACO) with rigid intraocular lens (IOL) and small incision cataract surgery (SICS) in camp patients reporting from hilly areas of Uttrakhand in terms of safety, efficacy and final visual outcome. *Design:* Retrospective study *Material and Methods:* A total of 214 patients of senile cataract were enrolled in this study conducted in ophthalmology department SGRRIM & HS, Dehradun, India over a period of twelve months. The participants were divided into PHACO and SICS as group A and group B respectively. The final outcome measures were the uncorrected visual acuity (UCVA) on day one, best corrected visual acuity (BCVA) at six weeks, the surgical induced astigmatism (SIA) at six weeks, the intraoperative and postoperative complications. *Results:* Post-operative UCVA at day one was 6/18 or better in group A (72 of 104 eyes - 69.2%) as compared to group B (20 of 112 eyes -18.2%) and statistically significant ($p < 0.001$). The post operative BCVA at 6 weeks follow up revealed overall good visual outcome between 6/6 - 6/9 with PHACO group (76 of 104eyes -73.1%) showing better results than SICS (55 of 110 eyes -50.0%) group. ($p < 0.001$) The mean SIA at the end of six weeks in Group A (PHACO) was 1.10 ± 0.51, and in Group B (SICS) was 1.22 ± 0.42. ($p = 0.065$). Overall incidence of intra operative complications was 8.7% in group A and 13.6% in group B. ($p<0.619$). *Conclusions:* Although both surgical techniques are sutureless, safe and effective for visual rehabilitation of cataract patients in camps, our study shows PHACO group demonstrating better final visual outcome as compared to SICS group. However, there was no significant difference in terms of surgically induced astigmatism and the complication profile.

Keywords: Camp; Visual Acuity; Astigmatism; Phacoemulsification.

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Introduction

Phacoemulsification with foldable intraocular lens is time tested now for senile cataract in modern era of ophthalmology still manual small incision cataract surgery (SICS) is preferred choice in developing countries for high volume camps being cheaper and non machine dependent [1]. Blindness due to cataract is associated with considerable disability resulting in large socioeconomic consequences [2,3]. Majority of camp patients coming from hilly region are either daily wage workers or farmers or old women with household responsibilities, are poor in follow ups but at the same time they do expect quick recovery. This category of rural and illiterate patients pose special challenge to the surgeon. As astigmatism is an important issue with clear corneal phacoemulsification (PHACO) and rigid intraocular lens (IOL) implantation in camps, apart from cost factor and learning curve, it does not seem to have much impact on final functional vision which remains the main concern of the patient.

To our knowledge not many studies have been

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done in this region on such patients travelling down all the way to Doon valley from hilly terrains of Uttrakhand in the hope of visual rehabilitation. Most of the patients were from Pauri Garhwaal district. Though it is a small study, we have made an honest effort to make a comparative assesment of clear corneal PHACO and manual SICS techniques in camp patients in terms of final visual outcome, post operative astigmatism, intraoperative and postoperative complications.

Materials and Methods

A retrospective study was conducted in the ophthalmology department of SGRRIMHS Dehradun, India on patients of senile cataract who were operated over a period of twelve months from September 2017 to August 2018. The complete data was obtained from central record section and refraction registers maintained in the out patient department after permission granted by hospital research committe.

A total of 214 eyes of 214 patients were reviewed out of which 104 patients underwent phacoemulsification and 110 patients were operated with SICS technique, assigned as group A and group B respectively. The inclusion criteria for selection were all cases of senile cataract with different grades of nuclear sclerosis including brown cataracts and hypermature cataracts as well, with clear corneas and no or minimal (0.25D—0.5D) preoperative astigmatism. All patients were between the age group of 50-85 yrs. Exclusion criterion were glaucomatous eyes, corneal dystrophies, posterior segment pathology and patients with previous history of trauma or surgery. Patients who were lost in follow up and cases in which PHACO was converted to SICS due to extension of capsulorrhexis were also not included in present study. All the patients underwent complete ophthalmological evaluation including slitlamp examination, ophthalmoscopy, tonometry, keratometry and biometry. (USG-Ascan) The preoperative patients data was recorded in terms of age, sex, BCVA, grade of nuclear sclerosis (NS), Keratometry (K1 and K2) values, axial lenghth (Axl), IOL power and intraocular pressure (IOP).

Patients in Group A were operated by clear corneal superior incision on the same PHACO machine (Alcon Laureatte) with an incision size of 2.8 mm, which was enlarged to 6 mm at the end of surgery. Patients in Group B were operated by SICS technique with a scleral tunnel of 6 mm to 7 mm incision size. A rigid 6 mm optic IOL (PMMA) was implanted in both the groups. All the selected cases were done by the same surgeon (author) to avoid intrasurgeon variation .The final outcome measures of the study were uncorrected visual acuity (UCVA) at day one ,best corrected visual acuity (BCVA) at week 6, surgical induced astigmatism (SIA) at week 6, intaoperative and postoperative complications. As long term follow up was not done, posterior capsular opacification was excluded from postoperative evaluation parameters.

Results

We used chi-square test for analysis of various parameters and statistical significance was set at 95% confidence intervals, that is at a p-value of < 0.05 for comparison between two groups. Grouped vertical bar charts were used to illustrate final outcome measures.

Table 1 summarizes the comparison of the 2 groups (Group A: PHACO < n = 104 > and Group B: SICS < n = 110>) based on various clinical characteristics. The mean age of the sample was 61.77 ± 7.74 years, with majority of patients in their sixth decade of life and a male preponderance (116 males and 98 females) and there was no significant difference between two groups as far as age and gender is concerned. ($t = 3.743$, $p < 0.001$). However there was a difference between the two groups in terms of grade of nuclear sclerosis (NS), group A having significantly less mature cataracts (65.4% of NS+1 to NS+2) than group B (45.5% NS+3 to NS+4). ($p< 0.001$) The preoperative visual acuity was comparable between two groups and majority were in category of moderate visual impairment with BCVA between 6/6 to 6/24. (65.4% in group A and 54.5% in group B) There was no patient in PHACO group with visual acuity less than 3/60 compared to 20 (18.2%) in SICS group who were practically blind as per WHO classification. ($\chi 2 = 21.319$ $p < 0.001$).

Table 1: Socio-demographic and clinical variables

Variables	Group A PHACO (n = 104)	Group B SICS (n = 110)	Comparison (statistic, p-value)
	Mean (SD) or N (%)	Mean (SD) or N (%)	Independent sample t-test, Chi-squared test
Age (years)*	63.73 (6.59)	59.91 (8.30)	t = 3.743, p < 0.001
Gender			

Male	56 (53.8%)	60 (54.5%)	$\chi2 = 0.011$
Female	48 (46.2%)	50 (45.8%)	$p = 0.514$
Grade of Cataract*			
NS +1 to NS +2	68 (65.4%)	30 (27.3%)	
NS +3 to NS +4	32 (30.8%)	50 (45.5%)	$\chi2 = 41.121$
Brown Cataract	4 (3.8%)	10 (9.1%)	$p < 0.001$
Hypermature Cataract	0 (0%)	20 (18.2%)	
Preoperative Best-Corrected Visual Acuity			
6/6-6/18	4 (3.8%)	5 (4.5%)	
6/24-6/36	68 (65.4%)	60 (54.5%)	$\chi2 = 21.319$
6/60-3/60	32 (30.8%)	25 (22.8%)	$p < 0.001$
<3/60	0 (0%)	20 (18.2%)	
K1*	43.80 (1.72)	43.22 (1.51)	$t = 2.627, p = 0.009$
K2*	44.23 (1.78)	43.35 (1.50)	$t = 3.906, p < 0.001$
Axial Length (mm)	22.43 (0.96)	22.42 (1.12)	$t = 0.081, p = 0.936$
IOL Power (D)*	22.10 (2.25)	22.80 (1.78)	$t = -2.529, p = 0.012$
Intraocular Pressure	13.26 (3.20)	13.54 (3.56)	$t = -0.418, p = 0.677$

NS: Nuclear Sclerosis; K1, K2: Keratometry, IOL: Intraocular lens

Parameters; * = statistically significant difference

Table 2: Final outcome measures

Variables	Group A PHACO (n = 104)	Group B SICS (n = 110)	Comparison (statistic, p-value)
	Mean (SD) or N (%)	Mean (SD) or N (%)	Independent sample t-test, Chi-squared test
Post-operative Uncorrected Visual Acuity at Day 1*			
6/6-6/18	72 (69.2%)	20 (18.2%)	$\chi2 = 56.842$
6/24-6/60	32 (30.8%)	90 (81.8%)	$p < 0.001$
<6/60	0 (0%)	0 (0%)	
Post-operative Best-Corrected Visual Acuity at Week 6*			
6/6-6/9	76 (73.1%)	55 (50.0%)	
6/12-6/18	28 (26.9%)	35 (31.8%)	$\chi2 = 23.995$
6/24-6/60	0 (0%)	20 (18.2%)	$p < 0.001$
<6/60	0 (0%)	0 (0%)	
Surgically Induced Astigmatism (Dioptre)	1.10 (0.51)	1.22 (0.42)	$t = -1.858, p = 0.065$

Parameters; * = statistically significant difference

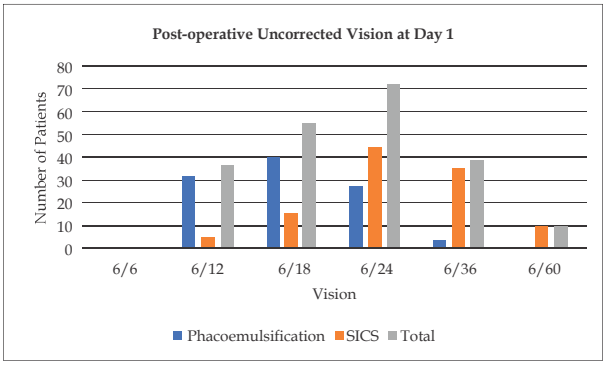

Fig. 1: comparison of post operative UCVA at day 1

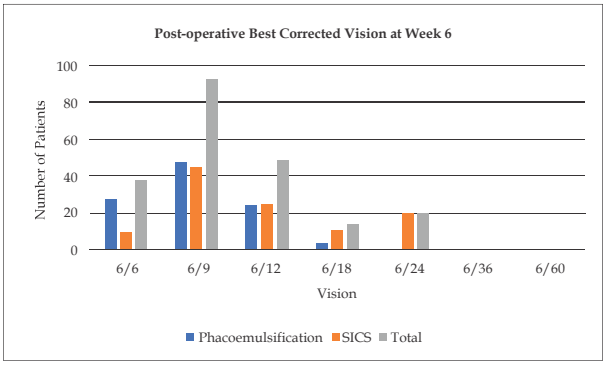

Fig. 2: comparison of post operative BCVA at week 6

Table 2 describes the final outcome measures .Postoperative UCVA at day one (Fig. 1) was 6/18 or better in group A (72 of 104 eyes - 69.2%) as compared to group B (20 of 112 eyes -18.2%) and this difference between two groups was statistically significant ($p < 0.001$). The postoperative BCVA at 6 weeks follow up (Figure-2) revealed overall good visual outcome (6/6-6/9) with group A (76 of 104 eyes-73.1%) showing better results compared to group B (55 of 110 eyes-50.0%). None of the patients in either group had poor outcome (<6/60) ($p < 0.001$). The mean surgically induced astigmatism (SIA) at the end of six weeks (Figure-3) in Group A (PHACO) was 1.10 ± 0.51, compared to 1.22 ± 0.42 in Group B (SICS) but statistically not significant ($p = 0.065$).

Table 3 illustrates the complication profile in both the groups. The overall incidence of intraoperative complications was 8.7% of 104 eyes in group A as compared to 13.6% of 110 eyes in group B . The posterior capsular rent (PCR) rate was lesser in PHACO group (2.88%) compared to 4.55% in SICS group. There was one case each of nucleus drop (0.96%) and corneal burns (0.96%) in group A while none in group B. Descemets detachment and iridodialysis was seen in 0.9% of SICS group while none in PHACO group. Zonular dialysis was seen in 0.96% and 2.77% in group A and group B respectively. ($\chi2 = 5.330$ $p < 0.619$). No major postoperative complications were noticed in either group. Shallow anterior chamber was noticed in 4 (3.63%) in group B as compared to 2 (1.92%) in group A. Hyphema was noticed in 2 (1.81%) cases and iris prolapse in 1 (0.9%) case of SICS group while none in PHACO. Striate keratitis and uveitis incidence were comparable in two groups. Raised IOP was seen in one case each in both the groups. The percentage of treatable postoperative complications was 14.4% of 104 eyes in group A as compared to 19.1% of 110 eyes in group B ($\chi2 = 3.130$ $p < 0.680$).

Table 3: Complication Profile

Variables	Group A PHACO (n = 104)	Group B SICS (n = 110)	Comparison (statistic, p-value)
	N (%)	N (%)	Independent sample t-test, Chi-squared test
Intra-operative Complications			
Posterior Capsule Rent	3 (2.88 %)	5 (4.55%)	
Anterior Chamber IOL	1 (0.96%)	3 (2.72%)	
IOL in Sulcus	2 (1.92%)	2 (1.81%)	
Nucleus Drop	1 (0.96%)	0 (0%)	$\chi2 = 5.330$
Corneal Burn	1 (0.96%)	0 (0%)	$p = 0.619$
Descemet's Detachment	0 (0%)	1 (0.9%)	
Iridodialysis	0 (0%)	1 (0.9%)	
Zonular Dialysis	1 (0.96%)	3 (2.72%)	
Total	**9 (8.7%)**	**15 (13.6%)**	
Post-operative Complications			
Shallow Anterior chamber	2 (1.92%)	4 (3.63%)	
Hyphema	0 (0%)	2 (1.81%)	
Iris Prolapse	0 (0%)	1 (0.9%)	
Striate Keratitis	6 (5.76%)	8 (7.27%)	$\chi2 = 3.130$
Uveitis	6 (5.76%)	5 (4.55%)	$p < 0.680$
Raised Intraocular Pressure	1 (0.96%)	1 (0.9%)	
Total	**15 (14.4%)**	**21 (19.1%)**	

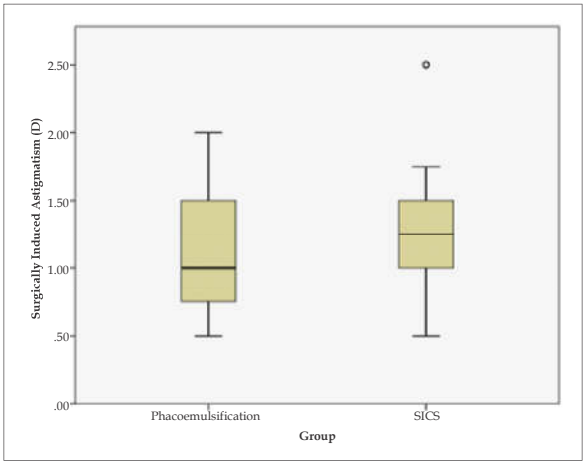

Fig. 3: comparison of SIA at week 6

Discussion

Although quite a number of similar studies have been conducted worldwide and reported in literature, we went ahead with this study with

a curiosity of results in this belt of Uttrakhand state, India. Most of the patients in our study were in sixth decade of life with male preponderance. The clinical and sociodemographic variables were comparable in both the groups. The postoperative UCVA at day one was 6/18 or better in majority of PHACO (69.2%) patients as compared to (18.2%) of SICS patients. The postoperative BCVA at 6 weeks follow up revealed overall good visual outcome (6/6 - 6/9) with again PHACO group showing better results (73.1%) than SICS (50.0%). None of the patients had poor outcome (<6/60). ($p < 0.001$) The mean SIA at the end of six weeks in PHACO group was, 1.10 ± 0.51 compared to 1.22 ± 0.42 in SICS group but statiscally not significant. ($p = 0.065$).

Our final outcome measures have been similar to the recent studies done. Cook C et al. have reported that there was no difference in the first day visual acuities (p=0.28) but both the UCVA and BCVA at 8 weeks were better in the eyes that had PHACO (p=0.02 and p=0.03) 4A randomised clinical trial done by Gogate PM etal. revealed 81.08% patients of the PHACO group 71.1% patients of the SICS group (P = 0.038) were better than or equal to 6/18 at the 6-week follow-up and the SIA was 1.1 D and 1.2 D, respectively. 5 Semanyenzi SE etal concluded that 'both types of surgery had similar post-operative outcome at 1, 3 and 6 months respectively (p=0.09, 0.19 and 0.12).' 6A recent study from south India has reported that on the 40th post-operative day, mean SIA in PHACO group was around 1.100476 and in SICS group, it was 1.124333 7 Another study done by Ammous I etal has shown lesser astigmatism in PHACO group (1.08 ± 0.42 D) than SICS group (1.51 ± 0.55 D) with significant difference (p=0.001).8 However some other studies were in favour of SICS like Jaya etal who reported higher SIA at the end of four weeks in PHACO group (2.06D ± 0.52D) compared to 0.98D ± 0.39 Din SICS group [9]. A prospective randomized clinical trial conducted in Nepal by Ruit S et al. concluded comparable UCVA in both groups but surgical time for SICS was much shorter. (p< .0001) [10].

The intraoperative complications in our study were more in SICS group (13.6%) as compared to PHACO group (8.7%). ($p < 0.619$) The PHACO group had three posterior capsular rents (PCR) including one nucleus drop which happened during chopping and rigid PMMA IOLs were placed in sulcus in two cases while ACIOL (Kelman multiflex) was implanted in latter case after vitrectomy. Compared to that five PCR occured in the SICS group with implantation of three ACIOLs and two PMMA IOLs placed in sulcus. Corneal burns was noted in one case in PHACO while none in SICS. One case of descemet detachment (DD) and two cases of iridodialysis (ID) occurred in group B which took place while expressing nucleus with wire vectis while none in PHACO group. Zonular dialysis (ZD) was seen in three cases of SICS which occurred while prolapsing the nucleus in anterior chamber in hard brown cataracts with weak zonules compared to one case in group A which occurred during cortical aspiration. The overall percentage of treatable postoperative complications was 14.4% in group A as compared to 19.1% in group B but statistically not significant ($p < 0.680$).

A study done by V Ramalaxmi et al. has reported 4.4% incidence in PHACO group and 10% in SICS group [7]. SE Semanyenzi and his colleagues report that the most common treatable postoperative complications were hyphema and corneal edema, with no statistically significant difference in the complications rate between both types of surgery (p=0.28) [6]. Our study showed slightly higher PCR rate in SICS group (4.55%) as compared to PHACO group (2.88%) similar to study of Naik AU etal who reported 6% and 2% in SICS and PHACO respectively [11]. Fortunately we did not have any dreaded complications like endophthalmitis or retinal detachment in either group. The complication profile comparison between two groups has been variable in various studies done so far as it all depends on the surgical competence [13,14].

Limitations of study: Since it is a retrospective study we had certain limitations, like lack of complete data in terms of specular microscopy, posterior capsular opacification and cystoid macular edema. The individual preferred technique and expertise of the surgeon also influences the final statistics.

Conclusion

Though our study has shown better outcome with phacoemulsification, we still feel patients who have to travel heights and generally lost in follow-ups, SICS technique should be preferred as far as wound safety and risk of postoperative endophthalmitis is concerned. In coming scenario with more number of trained PHACO surgeons, availability of low cost consumables, cheaper foldable IOLS and vitreoretinal backup, PHACO will turn out to be a better option in camp surgeries even in developing countries.

The authors declare no conflict of interest

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Dropped Nucleus: Earlier the Vitrectomy Better the Results

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Abstract

Aim: To determine safety and efficacy of pars plana vitrectomy (PPV) for dropped nucleus after complicated cataract surgery and evaluate the correlation of final visual acuity with time interval lapsed till active intervention done. *Material and methods :* We did a retrospective analysis of patients who underwent PPV for dropped nucleus in cataract surgery from july 2014 to August 2018 at SGRRIM & HS, Dehradun, India. The data was recorded in terms of details of complicated cataract surgery , point of occurrence of dropped nucleus, time elapsed till PPV done, the intraoperative and postoperative complications. Final outcome measures were the best corrected visual acuity (BCVA) at three months follow up and its correlation with time at which PPV was done. *Results:* Out of 14 cases of dropped nucleus during this four year period of study 3 (21.4%) patients were referred from outside , while 11 patients (78.5%) had the complication in our hospital itself of total 5760 cataract surgeries done contributing to an incidence of 0.191%. PPV was done in the same sitting in majority of cases (57.1%) with BCVA, 6/18 or better at the last follow up. One eye had retinal detachment two months postoperatively for which fluid/gas exchange was performed. All patients (92.9%) had IOL implantation except one (7.1%) who had corneal decompensation. The correlation between BCVA at three months follow up and time interval between complicated cartaract surgery and PPV was statistically significant ($\chi 2 = 14.000$, $p = 0.003$) , all those patients (21.4%) who were referred late and operated after one week had vision less than 6/60. *Conclusion:* Though dropped nucleus is a sight threatening complication of cataract surgery, PPV if done on time is safe and effective and the final visual outcome is definitely better in patients who get intervened early. However future studies with larger sample size and longer follow up are required to confirm our results.

Keywords: Dropped Nucleus; Vitrectomy; Visual Acuity.

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Introduction

Dropped nucleus is a sight threatening complication of cataract surgery but fortunately not that common, with an incidence of approximately 0.2% to 1.5% worldwide [1]. Posterior capsule rent (PCR) during cataractv surgery if not recognised early by the surgeon and managed appropriately, can lead to a complete nucleus drop or fragments in the vitreous. The main causative factors which can threaten vision if the complication not handled timely, are severe intraocular inflammation resulting in secondary glaucoma, corneal decompensation, cystoid macular edema (CME), and retinal detachment (RD) [2,3]. The usual approach for surgical intervention in eyes with dropped nuclear fragments is standard three port PPV and release of vitreous adhesions to the dropped nucleus, followed by fragmentation and removal of nuclear material which is commonly achieved using a phacofragmatome [4]. Our basic purpose of this study is to evaluate the safety and efficacy of PPV in dropped nucleus and highlight the importance of role of cataract surgeon in assessing the situation and timely referral to the vitreoretinal surgeon for further management.

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Material and Methods

We reviewed fourteen patients of complicated cataract surgery who had undergone PPV for dropped nucleus between July 2014 to August 2018 after approval of the study from the Institutional Ethics Committee. The data was recorded in terms of patient demographics including age, sex , pre existing ocular morbidities, details of complicated cataract surgery specifically the stage at which nucleus dropped, anterior vitrectomy done or not and IOL placed in same sitting or not, visual acuity, IOP, slitlamp and fundus findings at the time of intervention done. The clinical details including left out lens matter, vitreous or fibrin in AC, hypopyon, corneal edema, uveitis, vitritis, vitreous hemorrhage, approximate size of nuclear fragments in the vitreous, retinal tear or retinal detachment were recorded. The time interval between the complicated surgery and PPV and the management details were documented. The intraoperative and postoperative complications of PPV with further management were also recorded.The postoperative vision was recorded at day one, 6 weeks and 3 months follow up. Final outcome measures of our study were BCVA at the last follow up and its correlation with time interval lapsed till PPV done. Surgical technique used was a standard three-port pars plana approach employing a 23 gauge system (Retikare vitrectomy system). After making standard 3 ports, triamcinolone acetonide was used for visualization of vitreous in AC and anterior vitrectomy with removal of the residual cortical lens matter was done using the vitrector in aspiration mode. Then th core vitrectomy was done followed by PVD (posterior vitreous detachment) induction and the peripheral vitrectomy was completed. Main 23 port was removed and enlarged with MVR blade and then phacofragmotome was inserted through wound and fragmentation of dropped nucleus material was completed. A full peripheral search was done to check the retina for any iatrogeni tears or dialysis and remaining fragments of the nucleus. We routinely use intracameral triamcinolone again at the end of the operation to ensure that there is no residual vitreous, including removal of vitreous base as far as possible. Then an intraocular lens (IOL) was inserted in sulcus whenever it was possible or an AC IOL (Kelman Multiflex) was placed in other cases and ports closed thereafter. Postoperative treatment consisted of prednisolone eye drops every 2 hrs, tapered over a month, moxifloxacin eye drops every 4 hours, homatropine and timolol eye drops twice daily.

Results Data was analyzed employing SSPV software and P values less than 0.05 were considered as significant. The mean age of the study group was 62.61 ± 5.84 years comprising of 6 females and 8males .Out of total 14 patients, 3 patients (21.4%)were referred from outside while other 11 patients (78.5%) had nucleus drop in our hospital itself out of 5760 cataract operations done contributing to an incidence of 0.191% during this four year period. All dropped nuclei occurred during phacoemulsification except one case which happened while performing SICS. Three nuclei dropped by trainee surgeons while others in the hands of consultants. Majority cataracts were of grade NS +1 to NS+ 2 (57.1%) with preoperative BCVA in the range of 6/24 to 6/60 (42.9%). None had ocular comorbidities such as high myopia, pseudoexfoliation, previous vitrectomy or any other posterior segment pathology but two patients were hypertensives and one was controlled diabetic (Table 1).

Table 1: Pre cataract surgery details

Variable	Mean (SD) or N (%) (n = 14)
Age (years)	62.61 (5.84)
Gender	
Male	8 (57.1%)
Female	6 (42.9%)
Grade of Cataract	
NS+1 to NS+2	8 (57.1%)
NS+3 to NS+4	1 (7.1%)
Brown Cataract	4 (28.6%)
Hypermature Cataract	1 (7.1%)
Pre-operative BCVA	
6/6 – 6/18	2 (14.3%)
6/24 – 6/60	6 (42.9%)
<6/60 – 3/60	4 (28.6%)
<3/60 (Blind)	2 (14.3%)
K1	42.7 (1.64)
K2	43.14 (1.81
Axl	23.16 (0.96)
IOP	12.10 (4.3)
IOL Power	23.10 (3.36)
Type of Cataract Surgery	
SICS	1 (7.1%)
PHACO	13 (92.9%)
Surgeon	
Trainee surgeon	3 (21.4%)
Consultant	11 (78.6%)

NS: nuclear sclerosis, BCVA: best corrected visual acuity, Axl; axial length, K_1 and K_2: keratometry, IOP: intraocular pressure, IOL: intraocular lens, PHACO: Phacoemulsification

The nucleus drop occurred at various stages, 2 cases during trenching in phaco in soft cataracts, one happened just after first piece was chopped, 6 cases during second segment removal and 4 during last piece removal. One case needs special mention which occurred while prolapsing nucleus in AC during SICS. PPV was done in 8 eyes in the same sitting (57.1%) and in 6 eyes (42.9%) in second sitting. Out of 14 eyes IOL was implanted in 13 eyes (92.9%) including 11 IOLs in sulcus and 2 ACIOL s while one eye (7.1%) was left aphakic (Tables 2 and 3).

Table 2: Stages at which nucleus dropped

Stage	N (%) (n = 14)
During Trenching (PHACO)	2 (14.3%)
During Chopping (PHACO)	
After 1st Piece Removal	1 (7.1%)
During Last Piece Removal	4 (28.6%)
During 2nd Segment Removal	6 (42.9%)
Prolapsing the Nucleus in AC in SICS	1 (7.1%)

SICS: small incision cataract surgery, PHACO: Phacoemulsification, AC: anterior chamber

Table 3: Management details of PPV

Stage	N (%) (n = 14)
Same sitting Anterior Vitrectomy with PPV with IOL in sulcus	7 (50%)
Same Sitting Anterior Vitrectomy PPV with AC-IOL	1 (7.1%)
Second sitting PPV with Sulcus IOL within 48 hours	3 (21.4%)
PPV with Sulcus IOL placed after 1 week	1 (7.1%)
PPV with AC-IOL after 1 week	1 (7.1%)
PPV with no IOL after 1 week	1 (7.1%)
PPV Done in Same Sitting	8 (57.1%)
PPV Done in Second Sitting	6 (42.9%)

PPV: pars plana vitrectomy

Among those patients (6 eyes) in whom PPV was done in second sitting, BCVA was less than 3/60 to hand movements in 3 eyes and less than 6/60 in other 3 eyes. All the 6 eyes had vitreous in AC, 2 patients had raised IOP, 3 had significant uveitis and vitritis, one case of vitreous hemorrhage, and 4 cases had corneal edema. Majority of eyes (57.1%) were operated in the same sitting, 3 eyes (21.4%) within 48 hrs and the other 3 eyes after one week (21.4%) (Table 4).

Table 4: Timing of PPV and the findings at presentation

Variable	N (%) (n = 14)
Preoperative vision (PPV done in second sitting)	
<6/60 – 3/60	3 (21.4%)
<3/60 - HMCF	3 (21.4%)
Findings at presentation	
IOP Rise	2 (14.3%)
Corneal Edema	4 (28.6%)
Vitreous in Anterior Chamber	6 (42.9%)
Uveitis	3 (21.4%)
Vitritis	3 (21.4%)
Vitreous Hemorrhage	1 (7.1%)
Time Interval Between PPV and Complicated Cataract Surgery	
Same Sitting	8 (57.1%)
< 48 Hours	3 (21.4%)
48 Hours - 1 Week	0 (0%)
> 1 Week	3 (21.4%)

IOP: intraocular pressure, HMCF: hand movement close to face

Visual acuity increased after PPV in all except one eye. Though the postoperative UCVA at day one was less than 3/60 in majority of eyes (50%) but vision improved to 6/18 or better in 8 eyes (57.1%) at 3 months follow up. Three eyes (21.4%) had vision in range of 6/60-6/24 and two eyes (14.3%) remained visually impaired (<6/60) and one patient (7.1%) practically blind with vision reduced to hand movements close to face. (Table 5, Fig. 1)

Table 5: Post PPV visual acuity

Variable	Mean (SD) or N (%) (n = 14)
Post-operative UCVA at 1 Day	
6/6 – 6/18	0 (0%)
6/24 – 6/60	2 (14.3%)
<6/60 – 3/60	5 (35.7%)
<3/60 – HMCF	7 (50%)
Post-operative BCVA at 6 Weeks	
6/6 – 6/18	6 (42.9%)
6/24 – 6/60	4 (28.6%)
<6/60 – 3/60	3 (21.4%)
<3/60 – HMCF	1 (7.1%)
Post-operative BCVA at 3 Months	
6/6 – 6/18	8 (57.1%)
6/24 – 6/60	3 (21.4%)
<6/60 – 3/60	2 (14.3%)
<3/60 – HMCF	1 (7.1%)

HMCF: hand movement close to face, BCVA: best corrected visual acuity, UCVA: uncorrected visual acuit

The correlation between BCVA at three months follow up and time interval between complicated cartaract surgery and PPV was statistically significant ($\chi 2 = 14.000$ $p = 0.003$), all those patients who were intervened after one week (21.4%) had vision less than 6/60 (Table 6).

Table 6: Correlation of BCVA at 3 months with timing of PPV

			BCVA at 3 months	Strength of Association
Timing of PPV	< 1 Week	11	> 6/60	$\chi 2 = 14.000$
	> 1 week	3	< 6/60	p = 0.003*

p*= statistically significant, PPV; pars plana vitrectomy, BCVA; best corrected visual acuity

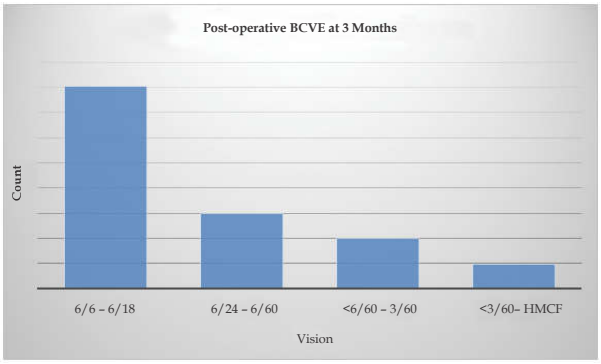

Fig. 1: showing post operative BCVA at 3 months

Retinal hemorrhage was the only intraoperative complication noticed in one eye which resolved spontaneously. No instance of scleral wound burn was observed. The treatable postoperative complications of PPV included secondary glaucoma in 2 eyes, uveitis in 7 eyes, corneal epithelial erosions in 3 eyes, striate keratitis in 6 eyes and CME was reported in one case. One eye had a rhegmatogenous retinal detachment (RRD) two months post PPV for which fluid/gas (PFCL) exchange together with 360-degree endolaser photocoagulation was performed and the patient is maintaining 6/18 vision now. One eye had corneal decompensation and was left aphakic (Table 7).

Table 7: Complication profile of PPV

	N (%)
Intraoperative Complications	
Retinal Hemorrhage	1 (7.1%)
Retinal Tear	0 (0%)
RRD	0 (0%)
Postoperative Complications	
Corneal Epithelial Erosion	3 (21.4%)
Striate Keratitis	6 (42.9%)
Uveitis	7 (50%)
Raised IOP	2 (14.3%)
CME	1 (7.1%)
RRD	1 (7.1%)
Corneal decompensation	1(7.1%)

CME: cystoid macular edema, RRD: rhegmatogenous retinal detachment

Discussion

"A dropped nucleus is a nightmare for any cataract surgeon but as in all surgeries, complications are unavoidable what is important is to recognize the occurrence of complications and to identify the causes and take measures to prevent them in future. A trainee surgeon should have a high index of suspicion of a PCR when there is sudden deepening of anterior chamber, tilting of the nucleus, brightening of the fundus glow and visible vitreous in AC. Predisposing factors are glaucoma , small pupil size, pseudoexfoliation, high myopia (Axial length ≥ 26 mm), subluxated lens, hard brown cataract or hypermature white cataract with week zonules." [5]. Robert Osher carried out a series of experiments on cadaveric eyes and concluded that in most cases the nucleus will sit supported by the vitreous if undisturbed but the post-occlusion surge due to high vacuum settings, can easily pull the vitreous supporting the nucleus toward the phaco tip, allowing the nucleus to drop. Also the turbulence created by phacoemulsification further increases risk of vitreous traction [6].

Anterior-segment surgeon can reduce the complications associated with dropped nucleus . Once PCR with vitreous prolapse is identified, bottle height level should be decreased, the second instrument should be withdrawn first and then a viscoelastic agent should be injected to tamponade the vitreous in the area of PCR followed by withdrawl of phaco probe from the paracentesis wound. This will prevent further anterior migration and incarceration of vitreous in the corneal wound and the risk of retinal tear [7]. Preservative-free triamcinolone acetonide may be useful to stain the vitreous and ensure that the anterior segment and all surgical wounds are clean by the conclusion of the anterior vitrectomy. Once the anterior chamber is free of prolapsed vitreous, any smaller nuclear or epinuclear fragments still available anterior to the posterior lens capsule may be carefully removed. The surgeon should ensure that all wounds are watertight before case is referred to vitreoretinal surgeon [8]. There is no universal agreement on when PPV should be performed. According to a British study presented at Pan Arab African Congress of Ophthalmology by Ibraheem El Ghrably of the Royal Victoria Infirmary, Newcastle, UK. All cases of posteriorly dislocated lenses should be referred promptly to a specialist vitreoretinal team, since the size of the fragments may be underestimated [9].

Our study was a retrospective analysis of 14

dropped nucleus, 11 in our department itself contributing to an incidence of 0.191% during this period, while 3 cases were outside referrals. PPV was done in 8 eyes in the same sitting (57.1%) and in 6 eyes (42.9%) in second sitting. Out of 14 eyes IOL was implanted in 13 eyes (92.9%) including eleven IOLs in sulcus and two ACIOL s while one eye (7.1%) was left aphakic. Majority of cases who underwent PPV in the same sitting (57.1%) had good visual outcome (6/18 or better). The correlation between BCVA at three months follow up and time interval between complicated cartaract surgery and PPV was statistically significant ($\chi 2 = 14.000$, $p = 0.003$), all those patients who were intervened after one week (21.4%) had vision less than 6/60.

A study done by Thevi etal reported an incidence of 0.6% and poor visual outcomes was delayed PPV leading to rise in intraocular pressure with resultant punctate epithelial erosions and retinal detachment [5]. "Another study reported an incidence of 0.2% and the mean follow-up was 5.6 months. A total of 48% cases were referred on the same day while 37% within one week and 66% of cases achieved a final visual acuity of 6/12 or better. Capsulorhexis complications, small pupils or improper surgical manipulation were the main causes and the optimum time for vitrectomy was as soon as possible ,preferably within 48 hours of the displacement," [9]. At the same time a large retrospective series reported no difference in visual acuity outcomes and complication rates between same-day and deferred PPV [12].

The RD rate in our study has come out to be 7.1% as compared to 8% reported by Smiddy et al. [13] and 5.5% by Moore et al [14]. A study conducted in 2003 by I.U. Scott et al. at the Bascom Palmer Eye Institute in Miami, Florida on 343 patients who underwent pars plana vitrectomy for retained lens fragments revealed that the" most important predictor of final visual acuity after PPV is a less complicated clinical course, specifically, no suprachoroidal haemorrhage, no retinal detachment, no cystoid macular oedema and no additional surgery. The most common cause of decreased final vision was cystoid macular oedema" [15]. The complication profile depends on the surgical competence and it was variable in different studies conducted so far. [16,17,18].

A study done by Al Amri AM etal recommends that to be on safer side vitrectomy should be extended peripherally using scleral depression to remove the nuclear fragmenrt that must have got embedded into the vitreous base. One should avoid retinal trauma by keeping phacofragmentation to minimum [19]. Also, as there is no counter-resistance by the capsular bag, it is essential to use a pulse or micropulse setting on the fragmatome, with low to moderate vacuum, to avoid bouncing the nuclear fragments around the vitreous cavity due to the repulsion caused by ultrasound energy. It is essential to keep potential future complications in mind when dealing with a perioperative complication. "A common misconception among anterior segment surgeons is that PFCL is used to float the nucleus into the anterior chamber from where it can be extracted through a limbal or corneal incision. In fact, the majority of displaced nucleus fragments can be dealt with safety in the posterior segment, with the PFCL acting only as a cushion to the macula while nuclear fragments are addressed with the fragmatome"[20].

Conclusion Therefore we conclude that though complications like dropped nucleus should be avoided, anterior segment surgeon can save eye from sight threatening consequences by detecting PC rupture early, immediately stopping phacoemulsification , performing a careful anterior vitrectomy and timely referral to vitreoretinal surgeon for pars plana vitrectomy which is safe and effective for visual rehabilitation of the patient.

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Limbal Stem Cell Deficiency: The Current Perspective

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Abstract

Limbal stem cell maintains the homeostasis around the cornea. Limbal stem cell deficiency (LSCD) occurs either by congenital or acquired causes due to the destruction of niche in the complex microenvironment. The diagnosis of LSCD is made on clinical findings and newer methods such as imaging modality, molecular markers and impression cytology which has led to more effective grading of the severity of LSCD and its strategic management planning. This article reviews the clinical presentation, newer techniques for diagnosis and management of LSCD.

Keywords: Limbal stem cell deficiency (LSCD); Diagnosis; Imaging modality; Molecular markers; Cytology.

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Introduction

Stem cells are undifferentiated cells that have the ability of proliferation, regeneration, converting into differentiated cells. According to 'niche hypothesis' by Schofield in 1983 the stem cells exist in an optimal niche that helps in their maintenance in an undifferentiated condition, after cell division one daughter cell re-enters the niche while the other enters the pathway of terminal differentiation [1]. The corneal stem cell niche is present at the limbus in the palisades of vogt [2].

Stem cells have the capacity to divide in an asymmetric manner, they are long lived and have a potential for error free proliferation [3]. The corneal epithelium which is regenerated every seven days has the source for this renewal by the stem cells at the basal layer of epithelium found at the corneoscleral limbus junction. It was described by Schirmer et al. that corneal epithelial cells at the limbus did not express 64k Da protein which was present in all other corneal epithelial cells thus postulating that these cells were less differentiated from other corneal epithelial cells [4]. These limbal cells prevented migration of conjunctival epithelial cells over the cornea. Limbal stem cells can also be found outside the palisades of Vogt including limbal epithelial crypts and pits [5].

Limbal stem cell deficiency occurs due to destruction of the nicheor by direct damage to the limbal stem cells, when a damage occurs the limbus loses its barrier function leading to replacement of corneal epithelium with conjunctival epithelial cells, which may further be complicated by neovascularisation in the cornea leading to the corneal opacity. This damage to the niche micro environment could be congenital or acquired. Congenital causes include aniridia, congenital erythrokeratoderma, keratitis which is associated with multiple endocrine deficiencies and epidermal dysplasias. Few of the acquired condition leading to LSCD are prolonged contact lens use, multiple surgeries over the limbal regions, ocular burns, radiotherapy, infections around limbus, topical medications like 5 FU or mitomycin-C, inflammatory disorders like Steven Johnson syndrome. The acquired causes lead to destruction of the stem cells directly and also affect the niche, whereas the congential causes have insufficient stromal microenvironment.

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Patients present with recurrent ocular pain, redness, watering, photophobia, visual loss. The diagnosis of LSCD is crucial because if this condition is detected early appropriate measures can be taken to prevent its progression and damage to the cornea. Previously the diagnosis was purely based on patient's symptoms and signs. But with newly developed imaging and molecular diagnostic markers, the diagnosis of LSCD has attained a massive leap. Impression cytology is atime-tested method to diagnose ocular surface disease, the cells which are collected on nitro cellulose acetate paper when examined under microscope if shows the presence of goblet cells implies conjunctivalisation of the cornea, however absence of the same doesn't rule out LSCD [6]. By in vivo laser scanning confocal microscopy (IVCM) LSCD shows variety of changes in the epithelium like increase in size of basal epithelial cells, less distinct borders, prominent nuclei also in advance cases metaplasia and neovascularisation [7].

Anterior segment optical coherence tomography (OCT) based on low coherence interferometry helps in elucidating limbal structure, normal and pathological structure especially with the spectral domain OCT which has an axial resolution of three microns [8]. The thickness of limbal epithelium is reduced significantly in LSCD when measured by AS OCT [9]. OCT angiography is another advanced method which is being used in the recent times for diagnosing LSCD as this method helps in visualising vessels and since corneal neovascularisation is not very specific for LSCD, this method has its limitations. Molecular biomarkers like cytokeratin 7 and 13 that is expressed by conjunctival epithelium and not corneal epithelium has been used as supplementary tool [10,11]. LSCD can often be misdiagnosed especially in its early stages because of non-specific symptoms which often mimic other ocular surface disorders and also because of nonspecific signs in the early stages.

Etiology

LSCD can result either by direct destruction of limbal stem cells or by destruction of limbal niche which is needed for their survival. Therefore, any pathological process that causes either of the dysfunction can lead to same phenotype of LSCD. LSCD can be either primary or secondary. The primaryis usually due to insufficient stromal microenvironment. The common primary causes are aniridia [12], keratitis associated with multiple endocrine deficiencies [13], congenital dyskeratosis [14], xeroderma pigmentosa [15], congenital epidermal dysplasia [16], LADD (lacrimo-auriculo-dento digital syndrome) [17].

The secondary causes can be either because of destruction of limbal stem cellsor due to damage to the stem cell niche. This could be due to ocular burns [18], Stevens Johnson syndrome [19], cicatrising ocular pemphigoid [20], radiotherapy and systemic chemotherapy [21], ocular surgeries around the limbus, prolonged contact lens use [22], topical [5], fluorouracil or mitomycin use [23], secondary to microbial infections [24], bullous keratopathy [25] and extensive ocular surface tumor [26] has been reported.

Clinical Presentation

The clinical symptoms of patients with LSCD are often varied and are non-specific. The presenting symptoms are often inadequate to make a certain diagnosis of LSCD. The patients may present with redness of conjunctiva, tearing, reduced vision, photophobia, blepharospasm, ocular pain, foreign body sensation. These symptoms are often due to repeated erosions and epithelial wound healing problems. These symptoms can be often be debilitating to the patients.

Present Diagnostic Methods

Clinical Findings on Slit Lamp Examination

Slit lamp examination is commonly used for the diagnosis of LSCD. Examination using fluorescein staining is essential especially in the early stages of LSCD to detect minimal changes. The disease is staged into mild, moderate and severe stage.

Mild Stage

In mild cases of LSCD there is loss of limbal palisades of Vogtusually in superior and inferior limbus, disarrayed perilimbal vasculature, loss of light reflex with dull cornea which can be irregular as well. Loss of limbal palisades of Vogt alone is not conclusive of LSCD [27]. The irregular surface and opacification of cornea is due to presence of abnormal cells, this can be a mixture of metaplastic conjunctival and corneal epithelial cells [28]. This irregular opacification may be visualised under white light however it is better appreciated with fluorescein staining and examination under cobalt blue light. When only a part of limbus is affected as in partial or sectoral LSCD a stippled pattern is seen in fluorescein staining this is as a result of

loss of tight junction between cells which leads to staining of basement membrane. The staining on abnormal areas remains even after 10 min and can be observed under slit lamp even after eye wash. As the disease progresses in sectoral LSCD a clear line of demarcation may be seen in between conjunctival and corneal cells.

Moderate Stage

As the limbal function deteriorates further there can be superficial neovascularisation, epithelial thinning, peripheral pannus formation. In this stage on fluorescein angiography vortex pattern may be seen. This is as a result of abnormal epithelium that forms a sheet that spreads from limbus onto the cornea in a spiral manner. If this invades the visual axis patient may have debilitating visual loss. This is also called 'whorl like epitheliopathy [29]. Peripheral pannus formation may also be present. Superficial vascularisation occurs as result of conjunctival epithelial cells that migrate over the cornea, these cells do not produce anti angiogenic factors like normal cornea [30]. This results in angiogenesis and peripheral pannus formation.

Severe Stage

As the disease progresses further recurrent or persistent epithelial defects can occur. Persistent epithelial defect can lead to scarring, neovascularisation of stroma, it can also lead to corneal ulcers and perforations. When the barrier function is lost there is a higher risk of microbial infection [31]. Stromal neovascularisation is common in severe LSCD. As the limbal stem cell deficiency increases further, with total lack of functional limbal stem cells there is absence of normal corneal epithelium. Thus, at end stage there is scarring and eventually opacification. This can lead to functional blindness. If there is associated tear deficiency, keratinisation may occur.

Impression Cytology

For the diagnosis of LSCD impression cytology has been the gold standard [32]. It is also used to diagnose other ocular surface disorders. Nitrocellulose acetate paper is used, it is placed on the ocular surface and it removes superficial 1-3 layers of cell. These cells are then subjected to examination. The histological examination can be done by using HE stain, Papanicolaou or PAS stain.Morphology and presence of goblet cells are evaluated. If there is presence of goblet cell it indicates conjunctival epithelial invasion over the cornea. Interestingly in 36% of patients there is goblet cell deficiency [33]. Even in cases of chemical or thermal injuries these goblet cells will be deficient. Therefore,absence of goblet cells does not rule out LSCD, it may lead to false negative results if used as the only indicator for LSCD. The sensitivity of the test depends on various factors. The site of sampling especially in cases of sectoral LSCD, the filter paper pore size, pressure that is applied on the sheet, surfactant treatment of the filter paper, type of filter paper is few of the factors affecting sensitivity of impression cytology. To improve the sensitivity of the test a surfactant free filter paper of pore size 0.22-0.40mm is used [34]. Surfactant free paper is used as presence of surfactant reduces the number of cells that are picked up. To prevent missing any area in cases of sectoral LSCD some use two D shaped halves of nitrocellulose sheet that covers the corneal and limbal surfaces. The epithelial morphology alone may not distinguish corneal from conjunctival epithelial cell.

Newer Techniques in the Diagnosis of Lscd

There are a lot of limitations in the present diagnostic modalities that are routinely used in the diagnosis of LSCD. Symptoms of LSCD are nonspecific as described previously and the signs elicited by slit lamp biomicroscopy are not pathognomonic of LSCD, also there is subjective variations in eliciting the signs. Variations like absent or disarrayed palisades of Vogt in few normal people or in the old, goblet cell deficiency in few individuals can create confusion while interpreting the results. To distinguish total from severe LSCD is difficult with use of slit lamp biomicroscopy and impression cytology alone. This is very important as prognosis after treatment is different in both conditions. As an attempt to overcome the limitations of present diagnostic modalities newer modalities have been tried.

In Vivolaser Scanning Confocal Microscopy (Ivcm)

IVCM is a non-invasive investigation tool used to study the microstructure of cornea and limbus. It provides high resolution images of the cornea. The superficial cells are loosely arranged polygonal, flat with hyperreflective cytoplasm. Normally the wing cells of the cornea havedark cytoplasm, no visible nuclei, and have very distinct borders. Whereas the deep basal cells are smaller in size, no visible nuclei and well-defined borders. The palisades of Vogt are double contour linear structures which are hyperreflective [35]. Some studies have

reported the presence of goblet cells on the cornea by IVCM as hallmark of LSCD [36]. But this is examiner dependent, thus has the same limitation as in impression cytology. Also, there is ambiguity between studies with regard to the morphology of goblet cells, as some studies have reported goblet cells to have the hyperreflective cytoplasm [37] where as other studies have the hypo reflective cytoplasm [38].

In LSCD the microstructural changes in the epithelium of the cornea occurs in the early stages (mild stages). In these patients the epithelial cells have less distinct borders and nuclei appears more prominent. As the disease progresses especially in severe cases of LSCD the cells are metaplastic, neovascularisation may be present. Basal epithelial cells are reduced and also the basal cells are larger in comparison with the normal eyes. The density is reduced by around 31% and the size is augmented by around 19.7% in LSCD [39,40]. The reduction of basal cells density is reported only for LSCD so far. The limbal epithelial cell morphological changes are similar to that of changes in corneal epithelial cells in LSCD. An average of 38.5% reduction in the limbal epithelial thickness has been reported by Chan et al. [41].

The sub basal nerve plexus is also affected in LSCD, these nerves have the function of protecting the eye by blink reflex, releasing various factors that help in maintaining the integrity of the epithelium and also help in wound healing. In LSCD there are changes in morphology and density of these plexus. Also, short nerve branches and sharp turns of the nerve that is branched has also been reported [42]. However, sub basal nerve plexus changes are not detectable in patients with chronic Stevens Johnson syndrome, cicatrising pemphigoid [43], toxic epidermolonecrolysis [44]. Changes in the nerve plexus are not specific to LSCD.

The stroma of cornea and limbus shows morphological changes in LSCD. The stroma in normal is hyperreflective which is replaced by fibrotic structure in LSCD [45]. Also, large number of dendritic cells, inflammatory cells along with the blood vessels may be present in the epithelium and deep stromal layers. Palisades of Vogt appear as linear structures that are hyperreflective and double contoured whichare altered or totally absent in LSCD. Even the limbal projections which are observed in normal eyes are also absent in LSCD. In sectoral LSCD lacunae like well demarcated structures are seen in the limbus. These contain clusters of highly packed normal limbal epithelial like cells.

To put it in a nutshell a normal range and the range to diagnose LSCD cannot be decided based on epithelial thickness and basal cell density as there are no enough studies to do so, also the variation of the two parameters with age also adds onto the diagnostic ambiguity. This would be an area of interest in the near future for further studies and research. Few of the limitations of IVCM are, it is expensive, needs training, can be traumatic as the lens touches the ocular surface.

Anterior Segment Optical Coherence Tomography (AS-OCT)

AS-OCT is easy to use, non-traumatic, does not require use of stain and topical anaesthesia, helps in comparing images on subsequent follow up. It is based on low coherence interferometry. Spectral domain OCT helps in high resolution imaging up to 5 microns and ultra-high resolution of less than 5 microns, called HR-OCT and UHR-OCT respectively. With this the detailed structure of corneal epithelium, conjunctiva and the corneal stroma of the anterior segment can be elucidated [46,47].

Epithelial thickness and limbal epithelial thickness are the few parameters used in diagnosis of LSCD by AS-OCT. According to Chen et al the mean corneal and limbal epithelial thickness was significantly reduced when compared to normal individuals in patients with LSCD [48]. Spectral domain OCT are used in visualising palisades of Vogt and it also helps in taking targeted limbal biopsies for transplantation [49]. However, the same limitation as in IVCM questions the specificity with respect to palisades of Vogt as an indicator for the diagnosis of LSCD as it may be absent in normal eyes.

However, to distinguish epithelial layer from underlying scar or stromal haze on AS-OCT imaging in patients with LSCD the factors like irregular epithelium, alterations in epithelial reflectivity, fibrovascular tissue underneath the epithelium which is hyperreflectivepose a problem. UHR-OCT helps to overcome this issue. OCT Angiography is a tool that is used in recent times to detect corneal neovascularisation but corneal neovascularisation is not specific for LSCD, hence its use in the diagnosis of the same is limited. However, it can be used for monitoring the extent of any neovascularisation that has occurred.

Biomarkers

Histology cannot distinguish corneal and conjunctival epithelial cells in impression

cytology. Molecular biomarkers help in distinguishing the two. Cytokeratins are keratin proteins which are important component of intermediate filaments, found in intracytoplasmic cytoskeleton of epithelial tissue. They help to resist mechanical stress. They can be detected by various methods like immunohistochemistry, RT-PCR, flow cytometry, liquid chromatography, electrophoresis. Biomarkers like cytokeratin 7 and 13 that is expressed by conjunctival epithelium and not corneal epithelium has been used as supplementary toolaccording to few studies [10,11]. Cytokeratin 3 and 12 are present on differentiated corneal epithelial cells, cytokeratin 19 and mucin 1 on conjunctival epithelial cells [50,51]. But some studies have shown that cytokeratin 3 is also present on conjunctiva, [52] therefore cytokeratin 12 is more specific for corneal epithelial cells. Cytokeratin 15 is also reported as specific marker for conjunctival epithelial cell by Yoshida et al. [53] Mucin 5AC is a specific marker for goblet cell. 54 Molecular biomarkers can be used along with in vivo imaging for the diagnosis of LSCD.

Current Treatment Options and Emerging Therapies for Lscd

Treatment of LSCD has options ranging from conservative to invasive depending on the severity of the deficiency of limbal stem cells.

Conservative Therapeutic Options

Nonsurgical

These include corneal scraping, supportive measures like amniotic membrane patching, success of this treatment depends on the remaining stem cells which can be rehabilitated.

a. *Autologous serum drops:* These helps in migration and proliferation of healthy epithelium. They also prevent adhesion of the epithelium to the tarsal conjunctiva [55].
b. *Therapeutic sclera lens/ bandage contact lens:* These therapeutic lenses helps in the healing of the persistent epithelial defects. Whereas therapeutic scleral lens in addition to healing of persistent epithelial defects also reduces pain and photophobia [56].
c. *Lubricating eye drops:* They act by reducing shear stress and preventing adhesion of epithelium to tarsal conjunctiva. They do not aid in the stem cell migration and proliferation.

Surgical

a. *Amniotic membrane:* It has antifibrotic, antimicrobial, anti-inflammatory, anti-angiogenic, anti-apoptotic properties in addition to low immunogenic property which aides in its healing effect. Amniotic membrane transplantation helps in migration of residual limbal stem cells and promotes its proliferation helping in healing of corneal surface. It is usually performed immediately after corneal scraping once the overgrown conjunctiva is removed [57].
b. *Corneal scraping:* This process helps in re epithelialisation of the cornea by the stem cells after the overgrown conjunctiva is removed. But the migration of conjunctival epithelial cells is faster than corneal epithelial cells necessitating repeated procedures [58].

Limbal Epithelial Stem Cell Transplantation

Conjunctival Limbal Autograft (Clau)

This technique uses graft derived from patient's healthy eye using conjunctiva as a carrier. From the superior and inferior limbal zones, limbal graft tissues along with conjunctival carrier is harvested and sutured on to the recipient site at the corneal and scleral margin. This has a risk of causing LSCD in the donor eye [59].

Conjunctival Limbal Allograft (Clag)

The allogenic graft can be retrieved from living related or deceased donor and also uses conjunctiva as a carrier. This process needs long standing immunosuppression and hence carries risk of neoplasia and infections. The surgical procedure is similar to that of CLAU [59].

Keratolimbal Allograft (Klau)

Here the graft is derived from the deceased donor. Using cornea as a carrier tissue 180 degree of limbal tissue is transplanted onto the limbal cell deficient eye [60]. This process also requires systemic immunosuppression and thus immunosuppression related morbidity.

Cultivated Limbal Epithelial Stem Cells Transplant (Clet)

This can be autologous or allogenic

transplantation. Cultivated stem cells are transplanted using either human amniotic membrane or fibrin as carrier. A small limbal biopsy is harvested which is then expanded in culture ex vivo and subsequently transplanted into the LSCD eye. There are two types of culturing techniques, suspension and explants. In suspension technique the cells are separated from the niche by enzymes and supported by feeder cells (mouse fibroblasts). In explant technique the specimen is transported to lab in HCE i.e modified human corneal epithelium. It is then shredded into pieces on to the Ham and then cultured in HCE medium with 10% autologous serum, 5% CO_2 and 95% air at 37% Celsius. The medium is changed on alternate days and a confluent monolayer is usually formed by 10-14 days which is visualised using inverted phase contrast microscope. This epithelial sheet is then transplanted into the recipient. It is held in place using fibrin glue and also by tucking the sheet under the conjunctival edge. The major advantage of this technique is reduced risk of LSCD in the donor eye and also reduced risk of rejection as Langerhans cells are not cultured in the composite graft, but the use of HAM bears the risk of disease transmission. There is also the necessity of immunosuppressants in allogenic transplantation with less HLA compatibility. Animal derived products are used in some protocols posing the risk of immune response or zoonosis [61]. The other limitation is that the culture laboratory facilities are expensive. A live related allogenic CLET shows promising results in patients with bilateral LSCD.

Simple Limbal Epithelial Transplant (Slet)

This technique avoids the need of expensive lab facility and is being used for unilateral LSCD. After harvesting a 2x2mm limbal graft from the unaffected eye, it is then divided into small pieces. Amniotic membrane is adhered with the help of fibrin over the recipient cornea and over this membrane 10-12 graft pieces are placed in a concentric manner avoiding the visual axis. A bandaged contact lens is placed over the transplant site. But the rate of stem cell expansion in the recipient site must be greater than the rate of proliferation of conjunctival cells for success of this transplant [62].

Cultivated Oral Mucosal Transplantation (Comet)

In 2003, Nakamuraet al described this technique in a rabbit model. Oral mucosal epithelial cells are cultured on HAM, it is transplanted onto the recipient once a stratified epithelium is attained [63] There is however a variable degree of keratinisation as the cultivated cells are not completely identical to corneal epithelium. It also has higher rates of peripheral neovascularisation according to few case series.

Hair Follicle Bulge- Derived Epithelial Stem Cells

These are derived from the bulge region of hair follicles. The stem cells from this region are able to differentiate into corneal epithelium when transplanted [64]. This concept was proven in the mouse model.

Human Embryonic Stem Cells

These cells are pluripotent and are obtained from the inner cell mass of human embryo. Zhu et al introduced these stem cells onto porcine cornea after they were induced to form limbal epithelial stem cell like cell [65]. The transplanted cells closely resemble corneal epithelium. However, there is ethical controversy surrounding this and also chance of immune response.

Boston Keratoprosthesis (Bkpro)

There are two types, Type 1 is used for patients with bilateral LSCD with good tear function, and type II is used for patients with bilateral LSCD with poor tear function.

Various other techniques have been used are currently under research. To list a few- Human immature dental pulp stem cells, mesenchymal stem cells, umbilical cord stem cells and amniotic epithelial cells.

Conclusion

The development of newer advances in diagnosis and treatment of LSCD has occurred in recent times. With the advent of modalities like IVCM the cornea can be examined at microstructural level noninvasively. However meticulous evaluation and management of LSCD remains a challenging task. Research into complexities of limbal stem cells will help in better understanding of the disease evolution and also open up doors that lead to better targeted therapy leading to successful outcomes.

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Article in supplement or special issue

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[9] National Statistics Online—Trends in suicide by method in England and Wales, 1979-2001. www.statistics.gov.uk/downloads/theme_health/HSQ20.pdf (accessed Jan 24, 2005): 7-18. Only verified references against the original documents should be cited. Authors are responsible for the accuracy and completeness of their references and for correct text citation. The number of reference should be kept limited to 20 in case of major communications and 10 for short communications.

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