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Prospective Study of Visual Outcome Following Nd : YAG Laser Posterior Capsulotomy

G Adarsh Reddy[1], G Narender Reddy[2]

Abstract

Introduction: Cataract is defined as any opacity in the crystalline lens of the eye that impairs vision. It can lead to clinically significant reduction in visual acuity, impaired contrast sensitivity, glare disability and monocular diplopia. PCO can be managed in two ways- Surgical capsulotomy and Nd : YAG laser capsulotomy. *Aims:* Visual outcome, IOP changes and Complications following Nd : YAG laser capsulotomy *Materials and Methods:* This is a prospective study of 104 patients, attending the regular out-patient department of Ophthalmology, conducted in Mamata General Hospital, Khammam, from November 2015 to September 2017. *Results*: Improvement of visual acuity was excellent with 80.77% improving more than 3 lines on the snellen's chart, 1 week after the procedure. There was significant difference in IOP before and 4 hours after the laser, but the IOP returned to pre-procedure value 24 hours after laser, since we used 0.5% timolol topical eye drops to blunt the intraocular pressure spikes. There are no cases of endophthalmitis reported in the present study. 95.2% of the patients improved by 3 lines and more. 4.81% of the patients showed improvement by 2 lines. *Conclusion:* Improvement in visual acuity is excellent post Nd : YAG laser capsulotomy. It is relatively non invasive and can be performed as an out-patient based procedure. This treatment modality is cost effective and relatively safe.

Keywords: Nd : YAG laser capsulotomy; Posterior capsular opacification; Surgical capsulotomy.

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Introduction

Cataract is defined as any opacity in the crystalline lens of the eye that impairs vision. Cataract extraction is the most frequently performed surgical procedure in patients over 65 years of age. Sometimes, the left out posterior capsule after the cataract surgery, opacifies by forming a dark cloud in front of the visual field known as posterior capsular opacification. It can lead to clinically significant reduction in visual acuity, impaired contrast sensitivity, glare disability and monocular diplopia. Posterior capsular opacification is also called secondary or after cataract. The posterior capsular opacification (PCO) is the most frequent late postoperative complication associated with decreased vision following cataract surgery. The incidence of development of PCO is 25 to 50%, between 2 months and fiveyears following the initial surgery [1]. PCO in pediatric age group is a major problem where the incidence approaches 100%.

PCO can be managed in two ways- Surgical capsulotomy and Nd : YAG laser capsulotomy. Before introduction of Nd : YAG laser, only surgical cutting or polishing of the posterior capsule could manage opacification of the posterior capsule following ECCE. After the introduction of Nd : YAG laser, laser capsulotomy became the method of choice in treating PCO. Nd : YAG laser posterior capsulotomy introduced a technique for closed eye, effective and relatively safe opening of the opacified posterior capsule and laser capsulotomy became the standard of care. Nd : YAG laser capsulotomy

Author Affiliation: [1]Assistant Professor [2]Associate Professor, Department of Ophthalmology, MNR Medical College and Hospital, Sangareddy, Telangana 502285, India.

Corresponding Author: G Narender Reddy, Associate Professor, Department of Ophthalmology, MNR Medical College and Hospital, Sangareddy, Telangana 502285, India.

E-mail: dradarshreddy26@gmail.com

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is usually a safe procedure but it may sometimes cause complications. Complications are more pronounced when higher single pulse energy levels are used and with large capsulotomy size.With this background knowledge which has been revised in detail in subsequent chapters, a hospital based prospective study of visual outcome following Nd : YAG laser posterior capsulotomy is done.

Materials and Methods

This is a prospective study of 104 patients, attending the regular out-patient department of Ophthalmology, conducted in Mamata General Hospital, Khammam, from November 2015 to September 2017.

Inclusion Criteria

All patients diagnosed clinically with PCO following SICS with PCIOL implantation above the age of 35 years.

Exclusion Criteria

1. Patients presenting with any other media opacity like corneal opacity etc.

2. Retinal disease accounting for visual loss.

3. Patients who are unable to fixate adequately for the procedure.

Detailed history was taken of each patient and recorded on specifically designed proforma. History was obtained with special attention to characteristic symptoms of decreased visual acuity, glare, or altered colour sensitivity, and the duration between surgery and the development of visually significant symptoms.

Visual acuity was checked using Snellens''s visual acuity chart and pinhole improvement was noted. Slit lamp examination was done to assess the cornea and also to assess the type and grade the PCO. Fundus examination was done using 90 D lens. IOP was measured using applanation tonometry before the procedure. Pupils were dilated using tropicamide 0.5% and phenylephrine 5% drops.

Assessment of PCO: Pupils were dilated and slit lamp biomicroscopy using retroillumination was performed giving special attention to posterior capsule under the IOL optic. PCO grading was done as by Madurai Intraocular Lens Study IV.

Grade 0: No posterior capsule opacification before and after pupillary dilatation. Direct ophthalmoscopy gives clear view of the optic disc, blood vessels and nerve fibre layer.

Grade 1: No central posterior capsule opacification is seen. PCO is seen only with pupil dilated to a minimum of 6mm. Dilated ophthalmoscopy gives clear view of optic disc, blood vessels and nerve fibre layer.

Grade 2: Posterior capsular opacification is present in the central visual axis detectable with an undilated pupil. With direct ophthalmoscope, there is mild obscuration of fundus detail with the optic disc clearly seen, but the blood vessels and retinal nerve fibre layer are not clearly visible.

G*rade 3:* posterior capsular opacification is present in the central visual axis with an undilated pupil. Direct ophthalmoscopy shows marked obscuration of fundus details with even the margins of the optic disc not clearly defined.

All patients with grade 2 and grade 3 PCO were subjected to Nd : YAG laser posterior capsulotomy.

Procedure

- Patient was explained the procedure and an informed consent was taken.
- Topical anesthesia achieved using 1–2 drops of proparacaine 0.5% .
- Patient was seated comfortably at NIDEK YC-1600 ophthalmic YAG laser system and an illuminated target was provided to the patient for maintaining steady fixation.
- Abraham lens (contact lens) was placed to stabilize the eye and to improve the laser optics and facilitate accurate focusing.
- A cruciate capsulotomy was created with the Nd : YAG laser, avoiding the central 4 mm of the lens and with the focus of the aiming beam slightly posterior to the posterior capsule.
- The opening was created beginning superiorly near the 12‘O clock and progressing down to and towards the 6‘O clock position. This is followed by placing the shots at 3 and 9‘O clock. Any flaps during the procedure are cut so as to cause them to retract and fall back to the periphery.
- Capsulotomy was started eccentrically with minimal energy 1 to 2 mJ/ pulse to predict the behaviour of the posterior capsule to the photodisruptive forces and to avoid pitting of

the IOL in the central position.

- Once the procedure is completed, the patient was adviced regarding the scheduled follow up of this study.

Post-procedure medications-The patients are put on topical steroids and 0.5% timolol eye drops.

Follow up

The IOP of the patient was measured 1 hour, 4 hours, 24 hours and 1 week after the procedure.

BCVA was recorded on Snellen's chart 1 week after the procedure.

The patient was followed up for 3 months after the procedure to look for any complications.

Statistical analysis to compare the pre procedure and post procedure intraocular pressure changes was done using paired t test.

Results

During the period of study from November 2015 to September 2017, 104 patients having posterior capsular opacification were identified and recorded. These 104 patients underwent Nd : YAG capsulotomy and the following observations were made.

Table 1: Demographic Distribution in study

Age	No. Of Patients	Percentage
31–40	1	0.96%
41–50	7	6.74%
51–60	42	40.38%
61–70	48	44.20%
71–80	6	5.78%
Total	104	100%
Gender		
Males	55	52.9%
Females	49	47.1%
Laterality		
Right	55	52.9%
Left	49	47.1%
Type of PCO		
Pearl	57	54.81%
Fibrous	47	45.19%
Grade of PCO		
Grade I	0	0
Grade II	78	75%
Grade III	26	25%
Duration between surgery and Nd:YAGcapsulotomy		
6 months – 1 year	21	20.19%
>1 year – 3 years	64	61.54%
>3 years – 5 years	16	15.38%
>5 years	3	2.89%

Maximum patients were in the age group of 61 – 70 years, the youngest patient being 39 years, and the oldest patient being 78 years. Out of the 104 patients, 53 were males and 47 females.

In this study, majority of PCO were encountered in the right eye. Most of the cases in this study had pearl type of posterior capsular opacification. 78 cases belong to grade II PCO and 26 to grade III. None of them are of grade I.

Maximum number of cases underwent YAG capsulotomy between a period of 1 year to 3 years. 20.19% patients presented within 1 year of surgery, 61.54% presented between 1-3 years after surgery, 15.38% between 3-5 years after surgery and 2.89% presented more than 5 years after surgery (Table 1). 2.9% of the patients have best corrected visual

Table 2: Pre-procedure and Post operativebest corrected visual acuity

Pre-Procedure BCVA	No. of Patients	Percentage
6/6	0	0%
6/9	0	0%
6/12	1	0.96%
6/18	14	13.46%
6/24	25	24.05%
6/36	15	14.43%
6/60	20	19.23%
Cf-5m	11	10.58%
Cf-4m	9	8.65%
Cf-3m	4	3.84%
Cf-2m	3	2.88%
Cf-1m	2	1.92%
Hm	0	0%
Total	104	100%
Postop BCVA		
6/6	34	32.7%
6/9	28	26.92%
6/12	15	14.42%
6/18	12	11.54%
6/24	8	7.7%
6/36	5	4.8%
6/60	2	1.92%
Cf	0	0%
Total	104	100%

acuity less than 6/60 and 14.43% have BCVA of 6/36, 24.05% patients have a BCVA of 6/24 and 14.42% patients had BCVA between 6/12 and 6/18. 14.42% of the patients had good pre procedure visual acuity between 6/6 to 6/18, 57.7% between 6/24 and 6/60 and 27.88% had poor pre laser BCVA less than 6/60. Post laser, 85.58% patients had good visual acuity between 6/6 and 6/18 and 14.42% between 6/24 and 6/60. None of the patients had post laser visual acuity of less than 6/60.

Best corrected visual acuity of all the patients who underwent YAG laser posterior capsulotomy had been done with appropriate glasses. Post laser BCVA improved for all patients showing the efficacy of the intervention applied. 32.7% of the patients improved to 6/6 BCVA (Table 2).

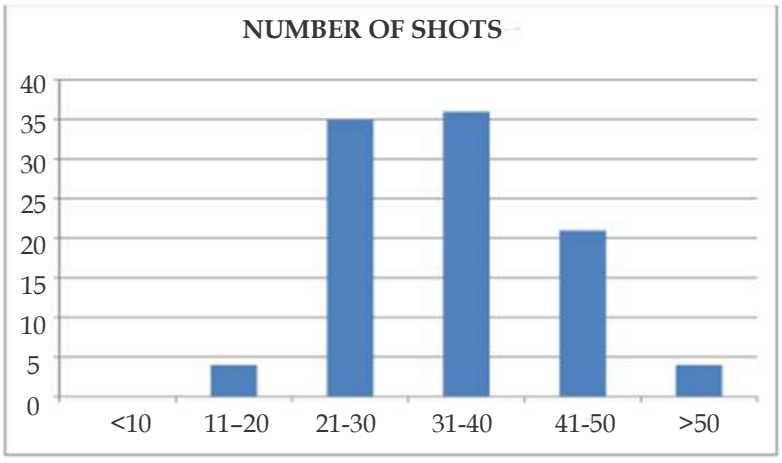

Fig. 1: Number of shots required.

Most of the patients required 31–40 laser shots. The maximum number of shots given were 59 and minimum 18 (Fig. 1).

Table 3: Laser energy per pulse and total energy

Energy per pulse	No. of Patients	Percentage
1 – 1.5	43	41.35%
1.6 – 2	49	47.11%
>2	12	11.54%
Total	104	100%
Total Energy		
<30	14	13.46%
30–60	41	39.42%
61–90	35	33.65%
91–120	12	11.55%
121–150	1	0.96%
>150	1	0.96%
Total	104	100%

Most of the patients were given laser energy per pulse between 1.6-2 mJ, the highest being 2.6 mJ and least 1.1 mJ. Most of the patients received total energy of 30–60 mJ, highest being 153.4 mJ and lowest being 22 mJ (Table 3).

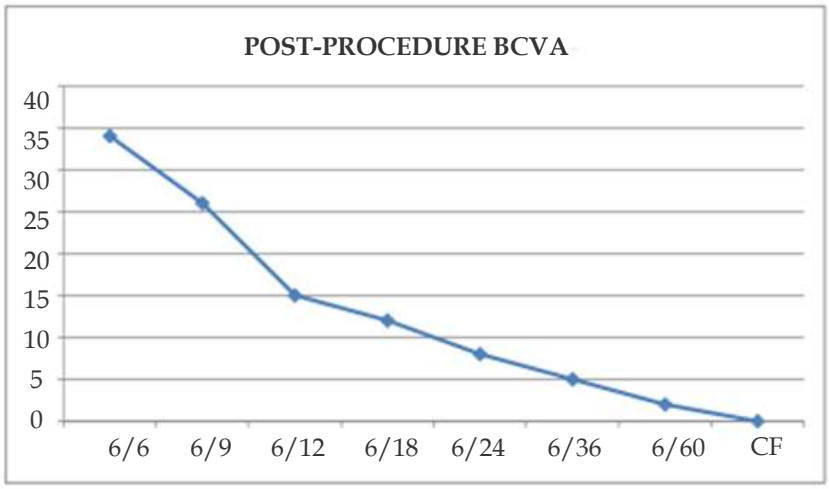

Fig. 2: Grading of pre procedure and post procedure BCVA

Table 4: Improvement in visual acuity

Improvement	No. of Patients	Percentage
No Improvement	0	0%
1 Line	0	0%
2 Lines	5	4.81%
3 Lines	15	14.42%
>3 Lines	84	80.77%
Total	104	100%

95.2% of the patients improved by 3 lines and more. 4.81% of the patients showed improvement by 2 lines (Table 4).

Table 5: Intraocular pressure changes

IOP	Pre laser		After 1 hour of laser		After 4 hours of laser		After 24 hours of laser	
	Number	%	Number	%	Number	%	Number	%
<12	3	2.89%	0	0	0	0	0	0
12–16	80	76.92%	83	79.81%	76	73.08%	81	77.88%
17–20	19	18.27%	19	18.27%	24	23.08%	21	20.20%
>20	2	1.92%	2%	1.92%	4	3.84%	2	1.92%
Total	104	100%	104	100%	104	100%	104	100%

Table 6: Complications of Nd:YAG laser capsulotomy

Complications	No. of Patients	Percentage
IOL pitting	6	5.77%
Raised IOP	1	0.96%
Iritis	4	3.84%
CME	0	0%
RD	0	0%
Hyphaema	0	0%
Total	11	10.57%

Three patients had a pre laser IOP of less than 12 mm of Hg. 80 patients had pre laser IOP between 12-16 mm Hg which increased to 83 patients after 1 hour of laser. 19 patients had IOP between 17-20 mm Hg before laser which increased to 24 patients 4 hours after laser. Only 2 patients had pre procedure IOP of more than 20 mm, Hg but 4 patients had more than 20 mm Hg IOP 4 hours after laser.

The above result shows that 59 patients showed no change in IOP after Nd : YAG laser posterior capsulotomy upto 24 hours while the remaining 45 patients showed some degree of change in IOP after Nd : YAG laser posterior capsulotomy in which most of the increase was in the range of 1-4 mm of Hg.

Only 2 cases in the present study showed an acute IOP rise upto 24mm Hg, 4 hours after the procedure.

Of the 43.26% patients with transient IOP rise, there was 2mm Hg rise in IOP, 4 hours after laser in 31.73% of the patients. The mean IOP before laser in the present study is 14.60 mm Hg which increases to 15.56 mm Hg, 4 hours post laser and returns to near baseline value 1 week after the procedure (Table 5).

The most common complication encountered in this study was IOL pitting seen in 5.77% patients. Iritis was seen in 3.84% patients. Other complications like cystoids macular edema, retinal detachment, hyphaema were not seen in this study (Table 6).

Discussion

Posterior capsular opacification is one of the most commonest cause of postoperative reduction in vision following cataract surgery. Nd : YAG laser is a non invasive, effective, relatively safe technique to treat PCO. Hence, it has established its place as a standard treatment for PCO replacing surgical capsulotomy.

Age

In the present study, the age group of the patients ranges between 39-78 years, which is similar to the study group of Cetinkaya *et al.* [2]. Wide range of age was seen in studies by Seethalakshmi *et al.* [3] and Bilal Khan *et al.* [4] as they included paediatric patients as well. The ranges of age in different studies are as follows-

In the present study, it was observed that PCO is more common in the age group of 61-70 years with 44.24% of the patients belonging in this range. This is in concordance with the study conducted by Seethalakshmi *et al.* [3] and Sandhya *et al.* [5] in which 45% patients were in the age group of 61-70 years.The mean age of PCO in the present study is 60.53 years. The mean age of occurrence of PCO in a study by Gopinath *et al.* [0] was 52 years and 71 years in the study by Hirnschall *et al.* [7] Studies by Wajeeha and Yuvaci *et al.* [8] showed the mean age of occurrence to be 66 years and 63.17 years respectively.

Sex

There was no significant sex predilection among the patients who developed PCO in the present study. Out of 104 patients in this study, 53 were males and 47 females. This is similar to the male - female ratio as seen in the study by Seethalakshmi *et al.* [3]. In the study by Khanzada *et al.* [9], 62.5% patients were males and 37.5% were females. Similar ratio was found in a study by Pankaj *et al.* [10]. This probably reflects that female populations less commonly present to hospital for their reduced vision after surgery. However, higher female to male ratio was seen in studies by Raza *et al.* [11], Bilal Khan *et al.* [4], Kim *et al.* [12] and Cetinkaya *et al.* [2]. The sex distribution of PCO in different studies is as follows-

IOL Status

In the present study, all the patients (100%) were

pseudophakic similar to the study group of Mrunal *et al.* [13]. In the study by Wajeeha *et al.* [8], 93% patients were pseudophakic and 7% were aphakic. In the study by Raza *et al.* [11] 80% of the patients were pseudophakic and 20% aphakic.

Type of PCO

The most common type of PCO in our study is the Elschnig pearl type seen in 54.81% of the patients and fibrous type was seen in 45.19%. Pearl type of PCO is also the most common type of PCO in other studies like Pankaj *et al.* [10]. However, fibrous type of PCO was more common in the study conducted by Bari K [14] with 57.04% patients showing fibrous type of PCO and 21.42 % patients having pearl type.

Duration from Surgery

In the present study, large proportion of patients, about 61.54%, had developed PCO between 1-3 years post surgery which is similar to the study by Cetinkaya *et al.* [2]. The duration from surgery in our study appears to be earlier than 3-5 years as reported by Pankaj *et al.* [10]. In the studies by Ang *et al.* [15], the duration was as less as 11 months and 3-12 months respectively.

Number of Pulses

Most of the patients required 31 - 40 laser shots. The number of pulses given in Bilal Khan [4] study was 6-19.Average number of pulses given in our study is 35.02 which is higher than the mean of 10.7 in Bilal Khan [4] study.

Energy Level

The pulse energy setting was kept as low as possible. Most of the patients were given laser energy per pulse between 1.6-2 mJ, the highest being 2.6 mJ and least 1.1 mJ. The pulse energy used in the present study was close to that used by Hirnschall *et al.* The energy level used by Bilal Khan [4] and Khanzada *et al.* [9] was 1.5-8 mJ and 1.5-5 mJ respectively. Pankaj *et al.* [10] used 2 mJ energy per laser.

Total Cumulative Energy

The total cumulative energy used was in the range of 22-154 mJ. Only few cases in our study required high energy levels. Most of the patients received total energy of 30-60 mJ.

Visual Improvement

Best corrected visual acuity of all the patients who underwent YAG laser posterior capsulotomy had been done with appropriate glasses. 14.42% of the patients had good pre-procedure BCVA between 6/6 to 6/18, 57.71% had between 6/24 and 6/60 and 27.87% had poor BCVA less than 6/60. Post laser, 85.58% patients had good BCVA between 6/6 and 6/18 and 14.42% between 6/24 and 6/60. None of the patients had post laser visual acuity of less than 6/60.

Post procedure BCVA improved for all 104 patients by atleast 2 lines or more in the Snellen's chart, showing the efficacy of the intervention applied. In the present study, 95.2% of the patients improved by 3 lines and more. 4.81% of the patients showed improvement by 2 lines.Visual improvement of 94.4% and 90% was seen in studies by Ajite *et al.* [16] and Pankaj *et al.* [10] respectively. 85.58% of the patients revealed good visual acuity between 6/6 - 6/18 after Nd: YAG capsulotomy which is similar to the study by Seethalakshmi *et al.* [3] but higher than the 73% seen in the study by Wajeeha *et al.* [3].

None of the patients in the present study had post laser BCVA less than 6/60, similar to the study by Seethalakshmi *et al* [3]. But 8.52% patients in the Bari K [14] study and 5% in the Dharmaraju *et al.* [11] study had vision below 6/60.

BCVA of 6/6 - 6/9 was achieved in 96.9% eyes in the study by Khanzada *et al.* [9] which is higher than the 58% achieved in our study.There was no improvement in visual acuity in 4% of the cases in a study by Hossain *et al.* and in other studies because of pre-existing fundus pathology which was not detected due to thick posterior capsule opacification. None of the patients in our study reported further deterioration in vision in post laser period.

IOP Changes

The above result shows that 55% of the patients showed no change in IOP upto 24 hours after Nd : YAG laser posterior capsulotomy while the remaining 45% patients showed some degree of change in IOP after Nd : YAG laser posterior capsulotomy in which most of the increase was in the range of 1-4 mm.

Only 2 cases in the present study showed an acute IOP rise upto 24 mm Hg, 4 hours after the procedure. One was a known case of glaucoma. Both the cases were successfully treated and the

pressures returned to baseline value over a period of 1 week.

In the present study, the maximum rise in IOP from the baseline value is 4 mm Hg. Khanzada *et al.* [9] reported a rise in baseline IOP of about 8-10 mm Hg in 3.1% patients during the 1st 24 hours. Bilal Khan *et al.* [4] showed a mean IOP elevation of 7.4 mm Hg above baseline.

Of the 45% patients with transient IOP rise, there was 2 mm Hg rise in IOP, 4 hours after laser in 33% of the patients which is similar to that observed in the study by Dharmaraju *et al.* [17]

An IOP rise of 4mm Hg was observed in 8% patients 4 hours after the procedure. But Pankaj *et al.* [89] showed that 37% of their patients had an IOP rise of more than 4 mm Hg, 4 hours after the procedure.The IOP levels returned to the pre procedure levels in most patients 1 week after the procedure, in contrast to the study by Karahan *et al.* [18] in which the IOP increased 1 week after Nd : YAG laser capsulotomy and declined to pre procedure levels at 4 weeks post laser.

None of the patients in our study had persistant IOP rise but 3.5% of the patients in Gore VS study 94 and 1.26% patients in Bhargava R *et al.* [19] study showed persistant rise of IOP.

The mean IOP before laser in the present study is 14.60 mm Hg which increases to 15.56 mm Hg, 4 hours post laser and returns to near baseline value 1 week after the procedure.

This shows that, in the present study, change in mean IOP 1 hour, 24 hours and 1 week post laser is not statistically significant ($p>0.05$) but the change in mean IOP 4 hours after the procedure is statistically significant ($p<0.05$).

All patients exposed to energy levels >40mJ showed increase in IOP 4 hours post laser in the study by Pankaj *et al.* [10]. But in the present study, of the 75 patients who received a total energy of >40 mJ, only 36 patients developed a transient rise in IOP post laser. A study by Waseem MA showed raised IOP in 21 out of 35 (60%) patients in high energy group as compared to raised IOP in 32 out of 113 (28.32%) patients in low energy group. In our study raised IOP was noted in 36 cases out of 73 (49.31%) in high energy group as compared to 8 cases out of 27 (29.6%) in low energy group.

Complications

Nd : YAG capsulotomy is associated with significant anterior and posterior segment complications. Some studies recommend that side effects are more pronounced when higher single pulse energy levels are used rather than higher total laser energy.

IOL Pitting

IOL damage following capsulotomy has been attributed to faulty focusing of laser beam, close proximity of the IOL to the posterior capsule and inherent properties of IOL materials. In the present study, IOL pitting has been seen in 5.77% of the cases which is comparatively less than Dawood *et al.* [20] reported IOL pitting in 0.5% of cases respectively in their studies.

Cystoid Macular Edema

It has been reported to develop on 0.55% to 2.5% of eyes between 3 weeks and 11 months following Nd : YAG laser capsulotomy.76In the present study, no case of CME was encountered similar to the study by Raza [11] reported CME in 3% of 550 patients treated with Nd : YAG laser capsulotomy.

Uveitis

Transient anterior chamber flare may be seen post - laser treatment. However, persistent iritis or vitritis is rare. In the present study, uveitis in the form of iritis is seen in 3.84% of the patients while 4.8% had uveitis in a study by Pankaj *et al.* [10]. Khanzada *et al.* [9], Bilal Khan *et al.* [4] and Seethalakshmi *et al.* [2] reported 0.6%, 1.14% and 2% of uveitis cases respectively, which is lesser than the present study.

Retinal Detachment

RD may complicate Nd :YAG laser posterior capsulotomy in 0.01-4.1% of eyes. In the present study, none of the cases showed retinal detachment similar to Gopinath *et al.* [6] it is in 2% cases of retinal detachment were reported in studies by Raza [11] and Bhargava *et al.* [19]. In the present study, this complication didnt arise probably due to the absence of risk factors in the patients.

Hyphaema

In the present study, none of the patients had hyphaema. 7.6% patients in the Pankaj *et al.* [10] study were reported to have hyphaema.

Vitreous in Anterior Chamber

In the present study, there were no cases of ruptured anterior vitreous face similar to the study by Jain *et al.* However, vitreous in anterior chamber was noted in 0.62%, 2 % patients in the studies by Khanzada *et al.* [9] and Wajeeha, [8] respectively.

Endophthalmitis

There are no cases of endophthalmitis reported in the present study. It is uncommon in other studies also. Bilal Khan [4] reported 1 case (0.22%) of endophthalmitis in his study.

Other Complications

Other uncommon complications like corneal edema, papillary block glaucoma, macular hole are not seen in any case in the present study. Pankaj *et al.* [10] reported corneal edema in 6.8% patients and pupillary block glaucoma in 8.2% cases in their study.

Conclusion

Most of the laser procedures were done using energy between 1.6-2 mJ, maximum energy used was 2.6 mJ. The average total energy used was between 30-60 mJ, minimum being 22 mJ and maximum being 153.4 mJ. At 24 hours, the improvement of visual acuity was excellent with 80.77% improving more than 3 lines on the snellen's chart, 1 week after the procedure.

There was significant difference in IOP before and 4 hours after the laser, but the IOP returned to pre-procedure value 24 hours after laser, since we used 0.5% timolol topical eye drops to blunt the intraocular pressure spikes. Out of the 104 eyes treated, 1 patient had transient rise of IOP, IOL pitting was observed in 6 patients, uveitis in 4 patients.

From present study of Nd : YAG laser capsulotomy for posterior capsular opacity, we conclude that improvement in visual acuity is excellent post Nd : YAG laser capsulotomy. It is relatively non invasive and can be performed as an out-patient based procedure. This treatment modality is cost effective and relatively safe.

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Original Article

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Correlation Between Central Corneal Thickness and Degree of Myopic Refractive Error : An Indian Study

Hemaxi Desai[1], Surohi Shah[2], Pratap Desai[3]

Abstract

Aim: To assess the correlation of central corneal thickness (CCT) with the degree of myopia. *Methods:* This is a prospective observational study. A total 280 patients were enrolled in a refractive surgery clinic. Total ophthalmic assessment including refraction was performed. CCT was determined in each eye of the all patients using ultrasonic pachymeter. Five different reading were taken during morning time and average of it was considered. The correlation of CCT and the degree of myopia in dioptres (D) was identified by Pearson's correlation coefficient and multiple comparisons Dunnett's t test. *Results:* Mean age of patients 24.85 ± 1.41 in males and 24.61 ± 7.77 in females. Mean value of myopia was -5.70 ± 2.12 D and -5.87 ± 3.18 D in males and females respectively. Mean corneal thickness was 539.19 ± 42.42 µM in males while it was 531.46 ± 12.02 µM in females. The correlation between CCT and the degree of myopic spherical equivalent was statistically insignificant (r=20.13, p=0.72). The insignificant (p > 0.05) association was found between the CCT and myopia groups while CCT was divided in to two groups. *Conclusion:* There is no significant difference noted among myopic refractory error and CCT. There was no significant difference between CCT, which remains nearly same in all degree of myopic eyes. This is clinically irrelevant and it does not affect the management of patients.

Keywords: Pachymetry; Myopia; Central Corneal Thickness.

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Introduction

Corneal thickness is considered as a significant marker of corneal physiology and its changes may be demonstrating the various pathologies [1]. It is most important to collect the trustworthy corneal pachymetry value of all the patients so that thickness of cornea is measured accurately. Thickness of cornea is also considered as important factor while arranging the corneal refractive surgery (these values affect the concluding decision as to whether surgery is essential, the choice of a particular surgical procedure, problems related to follow up or the rate of postoperative complications) and determining the intraocular pressure (IOP) [2,3]. Various factors have been implicated in affecting the corneal thickness pachymetry such as the existence of any corneal deterioration, patient age, timing, using the contact lens [4]. The effect of refractive error on thickness of cornea has not been till date evidently established [5–7].

Myopia is one of the most ordinary eye abnormalities in the globe. The myopia or short sightedness is a nothing but the one type of refractive abnormality where in the resting condition of eye the parallel rays of light concentrate before the neurosensitive layer of the retina. This is the inverse condition to hypermetropia and the eye is comparative too large as compared to non myopic eye [8]. Myopia is determined with help of spherical power in diopters of the diverging lens needed to concentrate light onto the retina that can be represented as the spherical equivalent or refraction in the least myopic meridian [9]. Myopia influences about 25% and more than 80% of the people in the West and some Asian regions, respectively [8]. The modulations in choroid, elongated axial length (AL) and stretching of the retina and sclera are associated with myopic eyes [9]. Numerous of reports suggested that the deeper

Author Affiliation: [1]Associate Professor [2]Assistant Professor, Department of Ophthalmology, GCS Medical College, Ahmedabad, Gujarat 380025, India. [3]Consultant, Clear View Laser Center, Ahmedabad, Gujarat 380014, India.

Corresponding Author: Surohi Shah, Assistant Professor, Department of Ophthalmology, GCS Medical College, Ahmedabad, Gujarat 380025, India.

E-mail: surohishah2018@gmail.com

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anterior chambers, more Steepened corneas and major white-to-white corneal diameters found in the myopic eyes as compared to emmetropic, low-myopic and hyperopic eyes [10,11]. Multiple studies have been found the relationship of CCT with degree of myopia. However, the results of these studies are controversial and none of the studies have considered the mid-peripheral corneal thickness (PCT) in severe myopic eyes [10-15]. Numerous of studies showed that CCT was thicker in the myopic eyes [12] and studies reported that CCT was thinner in the myopic eyes [7,13] while some found no association of CCT with myopia [10,11,14,15]. These diversifying results suggested that the association of CCT with severe myopia is a controversial. Therefore, there is need of further study to generate evidences related to issue. The principal aim of current study was to assess the association of central corneal thickness (CCT) and degree of myopia in Indian population.

Methodology

Study setting: This was a cross sectional study involving 280 patients (498 eyes) who were admitted in ophthalmology department of a tertiary care teaching rural hospital for LASIK operation.

Ethical consideration: The experiment protocol was permitted by the institutional ethics committee and written informed consent was collected from all patients.

Patients selection: Inclusion criteria for the patients were adults of 18 years and more of either gender, having spherical myopia between -0.2 and -15.0 D; cylinder of -1.50 D or less, steady refraction since one year, no contact lens use from 2 weeks in case of soft lenses and 3 weeks in case of hard lenses prior to preoperative investigations. Patients having keratoconus or forme frusta keratoconus as showed by scan and/or pentacam were expelled from the study. Patients having suspected corneal dystrophy in eye, known ocular abnormality or previous ocular surgeries were also expelled.

Study procedure in detail: Each patient was passed through full ophthalmic examination. CCT measurement was done with an ultrasonic pachymeter (PACH SCAN of sonomedpachymetry) and detailed examination of both eyes carried out (both dilated and undilated pupils). Topical anesthesia with proparacaine hydrochloride 0.5% was given. CCT was determined in upright position of patient. A hand-held probe was aligned as perpendicular as possible on the central cornea. Five readings were taken and average of the readings was recorded. Also four readings from four points at peripheral cornea were taken because CCT is always less than peripheral corneal thickness. All the relevant data were recorded in a structured case record form.

Statistical analysis: Data is represented as actual frequencies, mean, and standard deviation as appropriate. Pearson correlation analysis was performed to assess the association of CCT with degree of myopia. The statistical analysis was performed by one way ANOVA followed by multiple comparisons Dunnett t test (two-sided) to evaluate association of CCT with various degree of myopia like 0 to –8 D, and –8 to -15 D. A similar comparison was done between the degree of myopia and CCT groups such as those with <480 µM and ≥ 480 µM. Data were analyzed using SPSS V.11.0, and significance was considered as $p<0.05$.

Results

The total number of patients meeting the inclusion criteria was 280 (496 eyes). Out of this 280 patients, 160 (57.14%) were males and

Table 1: Demographic parameters of the patients (n=280, 498 eyes)

Parameter	No. of patients
Sex	
Male	160 (57.14%)
Female	120 (42.86%)
Age (years)	
Mean age in males	24.85 ± 1.41
Mean age in females	24.61 ± 7.77
Range	15.4 – 59.0
Spherical equivalent (D)	
-2 to -8	408 (81.92%)
-8 to -15	90 (18.07%)

Table 2: Association of myopic spherical equivalent (SE) and mean CCT (n=498 eyes)

Myopic Spherical Equivalent (D)	No. of patients	Mean CCT	P value
-2 to -8	408 (81.92%)	532.54	>0.05
-8 to -15	90 (18.07%)	521.15	

CCT – central corneal thickness

Table 3: Comparison between myopia and central corneal thickness (CCT) groups

Group	Number	Mean (SD)	Range	P value
Myopia groups		CCT µM		
-2 to -8	408	532.54 (42.7)	447–618	0.2
-8 to -15	90	521.15 (48.4)	473–618	0.7
CCT groups		Myopia (D)		
Pachymatry > 480 µM	402	-4.71 (1.9)	(-2.25 to -8.00)	0.5
Pachymatry < 480 µM	96	-10.86 (1.8)	(-8.25 to -15.0)	

120 (42.86%) were females. Mean age of patients 24.85 ± 1.41 in males and 24.61 ± 7.77 in females. Mean value of myopia was -5.70 ± 2.12 D and -5.87 ± 3.18 D in males and females respectively. Mean corneal thickness was 539.19 ± 42.42 µM in males while it was 531.46 ± 12.02 µM in females. Demographic details of the study patients are shown in table 1.

The current study showed no relationship between CCT and the degree of myopic spherical equivalent ($r = 20.13$, $p = 0.72$). No significant association was found between CCT and degree of myopic spherical equivalent ($p > 0.05$) as showed in table 2. When CCT was split in to two groups, and compared with myopia, no significant association was found ($p > 0.05$) as shown in table 3.

Discussion

The CCT has dominant significance in clinical practice for numerous rationales like its affection on IOP determination. It is a very significant while arranging refractive surgery or other medical conditions. The mean CCT of subject was 542 ± 46 µM. This value was to some extent more than which suggested in their meta-analysis by Doughty and Zaman [4]. The mean CCT was 535 µM when taking healthy corneas with CCT values between 503 and 565 µM. Garcia- Medina *et al.* found got a CCT of 550 ± 36 µM, investigated a total 310 myopic eyes, which a little more as compared to result of current study. [16]. Al Mahmoud *et al.* [11] also got same CCT, which observed in the current study (543 ± 34 µM in 3091 eyes with myopia).

Multiple studies have been showed the association of CCT with refractive error. However, the results of studies are divisive. The previous studies showed that myopic eyes have a thicker CCT, [12] while some studies suggested that a thinner CCT in myopic eyes, [7,13] and multiple studies demonstrated no association of CCT with myopia [10,11,14,15]. Therefore, there is need to perform further study, which demonstrate the influence of refractive error on corneal thickness (by means of the AL or the SE). We got an insignificant relationship between the CCT with SE.

Kunert *et al.* evaluated the total 1214 myopic-eye and they obtained insignificant difference in association of cornea with severe and low degree of myopia [12]. Sanchis-Gimeno et al. evaluated the CCT in severe myopic eyes (range 12.00–24.00 D) as compared to low myopic eyes and they obtained insignificant differences in association of CCT with high and low degree of myopia. However, they found a same trend for the corneas with severely myopic eyes to be thicker as compared to low myopic eyes. Chang *et al.* [17] has demonstrated an opposite correlation of CCT with AL, which suggested that corneas are thinner in longer eyes (i.e., they have an extreme myopia condition). However, Chang *et al.* did not involve highly myopic eyes in a sample of 216 myopic eyes, showing an average SE of −4.17 D.

Some studies have not found any correlation of the CCT with SE or AL. Chen *et al*. [14] found insignificant correlation in evaluated 500 emmetropic, hyperopic and myopic eyes. Study sample as an exclusive group (without separation as per the degree of myopia) may have affected their conclusions. In the same way, AlMahmoud *et al.* [11] found a mean SE of −4.58 D, varying from

−0.13 to −14.00 D with an insignificant correlation of CCT with SE in a 3091 myopic eyes. AlMahmoud *et al.* did not evaluate the groups in section to identify any relationship that consequence from modulation in the degrees of myopia.

Another probable clarification for divisive results produced in various studies was to use of different corneal pachymeters to evaluate the CCT and SE. Notably, somewhat more CCT values were obtained with ultrasound pachymetry as compared to slitlamp-based pachymetry. [4] The thickness of cornea also affected by the time of day, which showed that corneal thickness was elevated in the morning as compared to afternoon. [4] The current study has been used PACH SCAN (sonomedpachymetry) in majority of patients at morning time only.

The absence of ocular abnormalities in the eye, the cornea thickens was independent to the SE from the center to the periphery [18] because of increase of Bowman's layer thickness as well as the stroma while reaching the corneal periphery [19]. The current study showed a thinner CCT for each sample and for each study group as compared to demonstrated by nasal, temporal, superior and inferior pachymetry. As predicted, each pachymetry (temporal, nasal, central, superior and inferior) was directly correlated ($r > 0.78$ $P < 0.05$). The evaluation of the corneal thickness of central and peripheral is also significant to assess the corneal biomechanical characteristics [20]. The previously reported studies showed the correlation of the corneal hysteresis with myopia [20,21]. They demonstrated low corneal hysteresis and thicker CCT in high myopic eyes (more than 6.00 D) [20], suggested that the mechanical strength is compromised in anterior part of the severe myopic eyes. But, they did not evaluate the peripheral pachymetry. Also, Jiang *et al.* [20] did not get the significant differences between CCT in without myopic (SE >−0.50 D) and various degrees of myopia [low myopia (SE between −0.50 and −3.00 D), moderate myopia (SE between −3.00 and −6.00 D) and high myopia (SE <−6.00 D)]. These findings consistent with our results and concluded that biomechanical aggravation relayed on severe myopia could be more correlated with corneal biologic changes as compared to anatomical disparity in central thickness. Corneal thickness is most significant in excimer laser refractive surgery of myopia.

The prevalence of myopia is raising and may be a developing issue in the future. Previous studies in Japan, Iceland, Denmark and North American native populations have demonstrated the raising prevalence of myopia. As a result there is an increased rate of refractive surgeries to correct myopia. With Lasik there is a general worry that one should not thin the cornea more than a given amount. So, it is careful to determine CCT before the surgery. The results showed the requirement of pachymetry investigation in preoperative as collection of excimer laser surgery in any degree of myopia to prevent post-surgery complications [22].

Though our study has evaluated the association of CCT with myopia among Indian population, it had few limitations. The axial lengths of the patients were not been determined to differentiate people with axial myopia from those with index myopia. But, patients were enrolled from a refractive surgery clinic and involved patients of myopia who were assessed for LASIK. These patients were not expected to have index myopia. We did not use an emmetropic sample for comparison and it was compared the data with population-based study data from the other regions and other countries in the current study.

Conclusion

There are insignificant association of CCT and myopic as well as very severe myopic. CCT remains nearly same in all degree of myopic eyes with minor variation, which are clinically inappropriate to myopic patient management.

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Original Article

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Study of Contrast Sensitivity After Nd : YAG Capsulotomy

Krishna Sindhu Nadella[1], Madan Mohan S[2], Sai Shilpa M[3]

Abstract

The present study was done to assess the Contrast sensitivity in patients who underwent Nd :YAG laser capsulotomy for posterior capsular opacification after cataract surgery. The study was conducted on 30 patients, diagnosed as having posterior capsular opacification (PCO) after uncomplicated cataract surgery. Visual acuity and contrast sensitivity assessment wereperformed before and after laser capsulotomy. In our study visual acuity and contrast sensitivity improved significantly post Nd : YAG capsulotomy.

Keywords: Contrast Sensitivity; Posterior Capsular Opacification; Nd :YAG laser Capsulotomy; Pelli Robson Contrast Chart

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Introduction

Posterior capsular opacification (PCO) is a common complication after cataract surgery [1]. At present the incidence of PCO post-cataract surgery is thought to be around 10% [2]. PCO causes difficulties for the patients in routine daily activities as patients may have good visual acuity but loss of contrast perception that can lead to visual disability [3].

The visible areas always have different luminance at different points and this difference in the luminance is called contrast. The ability to detect slight difference in luminance between two areas is called contrast sensitivity. Contrast is defined as ratio of the difference in luminance of these two adjacent areas to the lower or higher of these luminance values. The minimum amount of contrast that enables an individual to see a target is called contrast threshold [4].

Various charts are available to assess the contrast sensitivity like the Mars chart, Test chart 2000 and Pelli-Robson chart [5]. Contrast sensitivity measurement is most commonly performed by using the Pelli-Robson chart. Glare and contrast sensitivity testing are done in post cataract surgery patients to detect and typify the visual problems related to the surgical procedure [6].

Contrast sensitivity assessment has to be performed in those patients who have normal visual acuity but still experience visual problems. Visual function is impaired when contrast sensitivity is lost [7].

Posterior capsular opacification (PCO) is a common long term complication post-cataract surgery. It results in reduced vision and glare. Neodymium–doped yttrium aluminum garnet (Nd-YAG) laser capsulotomy is a relatively non-invasive procedure that is used in the treatment of PCO [8]. In the present study we have to attempted to assess the visual acuity and contrast sensitivity post Nd : YAG capsulotomy in our local population.

Aim

To study visual acuity and contrast sensitivity in pre and post Nd : YAG laser capsulotomy.

Materials and Methods

This was a prospective hospital based study

Author Affiliation: [1,2,3]Post Graduate, Department of Opthalmology, Santhiram Medical college, Nandyal, Kurnool district, Andhra Pradesh 518502, India.

Corresponding Author: Madan Mohan S, Post Graduate, Department of Opthalmology, Santhiram Medical College, Nandyal, Kurnool district, Andhra Pradesh 518502, India.

E-mail: madhanmohanreddy.s@gmail.com

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and was conducted over a period of one year in in the department of Ophthalmology at Santhiram Medical College. Patients attending Ophthalmology OPD with complaints of decreased vision or visual disturbances post cataract surgery and with PCO were selected for the study. A detailed ophthalmic history was noted for all the patients and all patients underwent detailed ophthalmic examination.

Inclusion Criteria

Patients with post cataract surgery who had posterior capsular opacification

Exclusion Criteria

1. Macular pathologies
2. Corneal and media opacities
3. Optic disc pathology
4. Intraocular lens (IOL) tear or subluxation

Evaluation was done by

- Snellen's chart for Visual acuity
- Pelli Robson contrast chart for contrast sensitivity
- Slit lamp examination
- Fundus examination – indirect ophthalmoscope
- IOP – Non contact Tonometry
- Capsulotomy – Nd : YAG laser

Results

None of the 30 patients had any complications related to the Nd : YAG procedure.

Table 1: Age and gender distribution of patients

Age (in years)	No. of patients	Percentage (%)	Males	Females
<20	0	-	-	-
21–30	2	7%	2	0
31–40	2	7%	1	1
41–50	7	23%	3	4
51–60	8	27%	3	5
61–70	11	36%	8	3
Total	30	100%	17	13

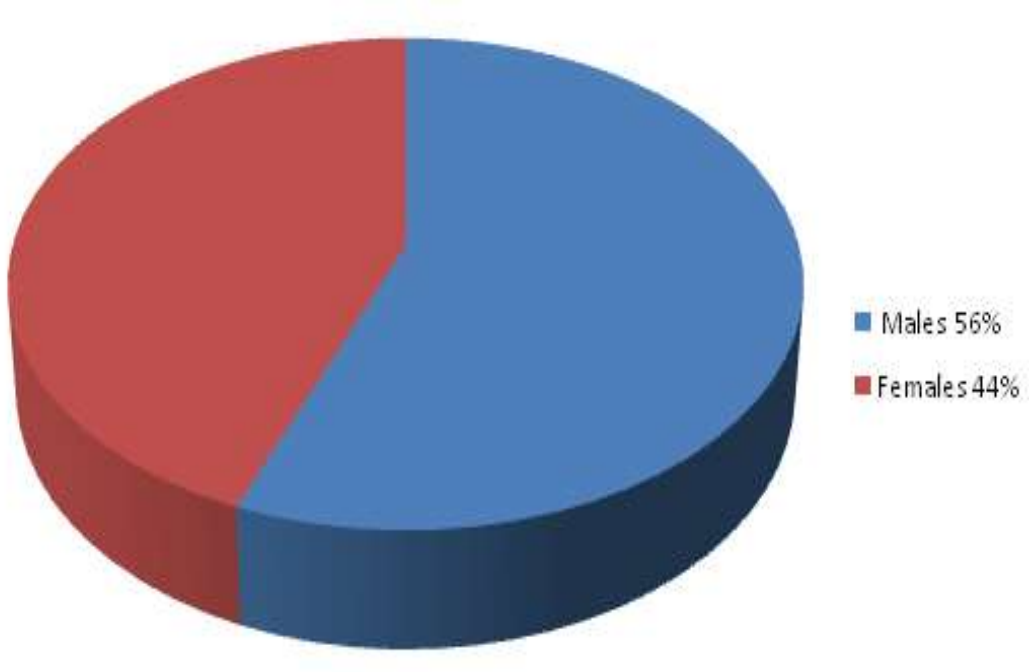

Fig. 1: Pie diagram showing gender distribution of the cases

Table 2: Distribution of cases according to visual acuity before and after laser capsulotomy

Visual acuity	No. of patients	Pre laser %	No. of patients	Post laser %
<6/9	0	0	1	3
6/9 – 6/12	5	17	19	64
6/18 – 6/24	12	40	7	23
6/36 – 6/60	9	30	2	7
6/60	4	13	1	3
Total	30	100	30	100

Table 3: Distribution of patients on the basis of contrast sensitivity before and after capsulotomy

Contrast sensitivity (log limits)	Pre capsulotomy No. of cases	Percentage (%)	Post capsulotomy No. of cases	Percentage (%)
0 – 1.50	14	47	5	17
1.55 – 1.65	7	23	4	13
1.70 – 1.80	7	23	5	17
1.85 – 1.95	2	7	10	33
2.00 – 2.10	0	0	6	20
2.22	0	0	0	0
Total	30	100	30	100

Discussion

Neodymium-doped yttrium aluminum garnet (Nd : YAG) laser capsulotomy is a relatively noninvasive procedure that is used in the treatment of posterior capsular opacification. Posterior capsular opacification (PCO) is a commonly encountered long-term complication of cataract surgery. It has to be suspected when patient complains of symptoms of a cataract like decreased vision and glare, despite the cataract being removed [9]. The incidence of posterior capsular opacification (PCO) has been reported variably in literature. According to Schaumberg *et al*. 25% percent of the patients, who underwent extracapsular cataract surgery developed significant PCO within the next 5 years post- procedure [1].

The mechanism for the development of PCO is due to the proliferation of lens epithelial cells inducing fibrotic changes and collagen deposition that wrinkle the posterior capsule. Also the lens epithelial cells gain myofibroblastic characteristics with capacity to contract that contribute to the capsular wrinkling. PCO incidence varies from 8.7% to 33.4% [10,11,12].

The neodymium : yttrium-aluminium-garnet (Nd : YAG) laser has a wave-length of 1064 nm and is used as short high power pulses. It acts by disrupting ocular tissue causing plasma formation which in turn gives rise to shock and sound waves that break down the tissue [12].

In the early 1980s Drs. Aron-Rosa and Fankhauser developed the technique of capsulotomy by using Yttrium aluminum garnet. Prior to the development of Nd : YAG technique, opacification was managed by surgical cutting and polishing of the capsule. PCO is commonly seen after extracapsular extraction of senile cataracts. The opacification develops at different rates in different individuals. Young people develop opacification more early than older individuals. Phaecoemulsification reduces the rate of opacification. Presence of diabetes mellitus also slows down the onset of opacification [12].

The contraindications for Nd : YAG capsulotomy are corneal scars, edema, wherein the aiming beam cannot be seen properly, active inflammation, cystoid macular edema, and uncooperative listless patient [12].

In the present study, the mean age of our patients was 52.54 + 11.89. In the study done by Aslam TM *et al*. [13] they found the mean age to be 75.2 years with the range between 52–90 years.

The male to female ratio in our study was 1.3:1. Baratz KH *et al*. [14] conducted a study on 2718 patients and observed women tended to have a greater probability of capsulotomy, but this difference was not statistically significant in their study.

In the present study, the mean visual acuity improved by two Snellen lines in 14 cases i.e. almost in half of the cases followed by one Snellen line in 11 cases, followed by three lines in 5 cases,

post capsulotomy. Albert DW [15] *et al*. reported that 75% of cases in 120 eyes had a posterior capsulotomy visual acuity of 6/12 or better and 54% had 6/9 or better vision.

Bari [16] from Bangladesh studied 70 patients for visual acuity who had PCO and were treated with Nd : YAG laser capsulotomy. They observed excellent improvement in the visual acuity in all the 70 patients post-procedure. In addition, none of the patients had any further deterioration of visual acuity on follow up.

Hasan *et al*. [17] did a similar study in 86 patients and found improvement of VA on Snellen's chart as 1–3 lines in 42 and 4–6 lines in 31 patients. Latif *et al*. [18] in their study on Nd : YAG laser reported 87.5% improvement in the visual acuity with an average 3 lines on Snellen's chart.

The contrast sensitivity was measured by using the Pelli-Robson chart. In our study, the mean contrast sensitivity after capsulotomy was 1.779 + .2923 log units. Magno BV *et al*. [19] measured visual functions before and after capsulotomy in 24 patients, using Pelli Robson chart. In their study, the contrast sensitivity improved with a mean difference of 0.24 log units with $p < 0.0001$. Cheng CY *et al*. [20] reported an improvement of contrast sensitivity in patients with both types of PCO in 29 patients. Our observations are similar to the studies of the above authors.

PCO occurring post cataract surgery can be reduced or prevented by using better tools of good quality tools, better surgical procedures, skills and appropriate IOL designs [2].

Complications may occur in some cases that include transient intraocular pressure elevation, iritis, retinal tears and increased chances of retinal detachments, macular and corneal edema, intraocular lens dislocation into the vitreous and disruption of the anterior vitreous [1,21,22,23]. None of the patients in our study had any major complications.

Nd : YAG laser capsulotomy gives good visual acuity in 83% to 96% of the cases. In some cases the visual acuity may not improve which could be due to preexisting eye disease, senile macular degeneration, cystoid macular edema, detached retina, edema of the cornea, glaucoma, or other causes [12].

Nd : YAG laser capsulotomy is a relatively noninvasive and safe, effective, rapid treatment choice done as an out-patient procedure and gives immediate results in visual improvement [12,21].

Conclusion

Posterior capsular opacification is a complication of cataract surgery which causes a decrease in visual function including reduction in contrast sensitivity and that after Nd : YAG laser capsulotomy the contrast sensitivity improves significantly, as measured by Snellens chart and Pelli-Robson contrast sensitivity chart.

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Comparison of Efficacy and Safety of Sutures Versus Fibrin Glue Versus Glue Free Sutureless for Conjunctival Autograft Fixation in Pterygium Surgery

KN Anisha Deepti[1], M Radhika[2]

Abstract

Introduction: Pterygium is a degenerative condition. Pterygium can induce visually significant astigmatic changes or may grow to occlude the visual axis. In the management of pterygium one of the major problems is the high rate of recurrence. *Aims:* To study the efficacy and complications of limbal conjunctival autografting using sutures, fibrin glue or autologous blood for graft adhesion after pterygium excision and to compare the results. *Materials and methods:* A total of 120 patients who underwent limbal conjunctival autografting after pterygium excision. Grafts were secured using autologous blood in 40 eyes, fibrin glue in 40 eyes and sutures in 40 eyes.Study was conducted during a period of 1 1/2 year in the Department of Ophthalmology, SVS Medical College and Hospital, Mahabubnagar. *Results:* Of the 120 eyes the grafts were secured in 40 eyes (33.3%) using autologous blood, 40 eyes (33.3%) using sutures and 40 eyes (33.3%) using fibrin glue according to the patient's choice.The mean time taken for surgery in the various groups of this study was compared and found to be highest with sutures (27.7 min) and least with the autologous blood method (15.70 min). No intra op complications were noticed in the three groups. All patients were followed up for a period of 6 months. Postoperative complications were more with the use of sutures and mild enough to subside with treatment in 1 week. Minimal graft displacement was noticed in 1 eye in the autologous blood method group which did not require any revision surgery.In this study single line improvement in postoperative Snellen's visual acuity was noticed in the three eyes with large pterygia unrelated to the method of graft adhesion. Recurrences were noticed in 3 of the 120 eyes over 6 months' follow up. *Conclusion:* In this study single line improvement in postoperative Snellen's visual acuity was noticed in the three eyes with large pterygia unrelated to the method of graft adhesion.

Keywords: Sutures; Fibrin Glue; Pterygium.

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Introduction

Pterygium is a degenerative condition, characterized by wing shaped overgrowth of bulbar conjunctiva on to the cornea, located in the interpalpebral area. Overall prevalence of the pterygium ranges from 0.7 to 3% [1]. It is common in India, where the risk of ultra-violet exposure [1] is more. Pterygium can induce visually significant astigmatic changes or may grow toocclude the visual axis.

In the management of pterygium one of the major problems is the high rate of recurrence. One of the most common methods of surgical management with least rate of recurrence (5%) is pterygium excision with limbal conjunctival autograft. In this context this study is done to compare methods of conjunctival autograft using (1) sutures (2) fibrin glue (3) autologous blood, in terms of efficacy and complications.

Aims

To study the efficacy and complications of limbal conjunctival autografting using sutures, fibrin

Author Affiliation: [1]Consultant Ophthalmologist, Department of Ophthalmology, Smart Vision Hospital, Hyderabad, Telangana 500072, India. [2]Associate Professor, Department of Ophthalmology, ESIC Medical College, Sanathnagar, Hyderabad, Telangana 500038, India.

Corresponding Author: M. Radhika, Associate Professor, Department of Ophthalmology, ESIC Medical College, Sanathnagar, Hyderabad, Telangana 500038, India.

E-mail: radhikam24@gmail.com

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glue or autologous blood for graft adhesion after pterygium excision and to compare the results

Materials and Methods

It is a Prospective comparative study conducted during a period of 1.5 years from October 2015 to February 2017, in the Department of Ophthalmology, SVS Medical College and Hospital, Mahabubnagar. The study was conducted according to the principles of the declaration of Helsinki and was approved by the hospital ethics committee. Informed consent was obtained from all patients included in the study. A detailed history followed by clinical examination and routine investigations were done for all patients.

Inclusion Criteria

Patients with pterygium including recurrent pterygium undergoing surgical management with conjunctival autograft

Exclusion Criteria

Bilateral Pterygium, Patients who are unable to come for followup

Procedure

A total of 120 patients who underwent limbal conjunctival autografting after pterygium excision were studied. Patient was given the choice of selecting the method of surgery. Grafts were secured using autologous blood in 40 eyes, fibrin glue in 40 eyes and sutures in 40 eyes.

All surgeries were performed by a single surgeon to reduce operator bias. After subtenon's block, the apex of the pterygium was scraped off from the cornea and whole pterygium excised. After measurement a limbal conjunctival graft slightly larger than the defect was prepared at the superior limbus of the same eye and moved to the raw area. The graft was held in place maintaining proper orientation, using sutures or fibrin glue or autologous blood.

Sutures used for securing the graft were 6-0 vicryl for conjunctiva and 10-0 nylon at limbus. Commercially available Fibrin glue consist of 4 vials: (1) Sealer Protein Concentrate (Human), Vapor Heated, freeze-dried, (2) Fibrinolysis Inhibitor Solution (Bovine), (3) Thrombin (Human), Vapor Heated, freeze-dried, (4) Calcium Chloride Solution.

Contents of the vials 1 and 2 and vials 3 and 4 were combined which forms a Sealer Protein Solution and Thrombin Solution. The Sealer Protein Solution and Thrombin Solution were then combined (by using the Duploject System, or equivalent delivery device) to form the Fibrin Sealant. It is applied to the raw area and graft is attached maintaining proper limbal orientation.

In the eyes where grafts are secured using autologous blood clot oozing at the excision site was neither cauterised nor washed off with saline. The autograft was secured in place while maintaining proper limbal orientation using the blood over the raw area. Using a non-toothed forceps direct pressure was applied over the graft and with the edges apposed. After securing the graft pad and bandage was applied. Time taken and any intra-operative complications were noted.

Patients were followed up on 1st postoperative day, at the end of first week, and 6 months. At each follow up patients were asked about their symptoms, slit lamp examination was done and visual acuity was checked.

Findings were recorded, tabulated and analysed using statistical software namely SPSS 15.0 and stata 10.1. Microsoft word and Microsoft excel have been used to generate graphs and tables.

Results

A Total of 120 patients were studied of which 70 males and 50 were females. All these patients underwent pterygium excision with limbal conjunctival autograft. These grafts were secured using sutures, autologous blood or fibrin glue as per randomization (Table 1 and Figs. 1 & 2).

Comparisons of Complications Based on Surgery

No intra-op complications were noticed in the three groups. Post-operative complications noted were postoperative pain, watering, congestion, subconjunctival hemorrhage, graft displacement and recurrence. Postoperative pain was graded according to visual analogue scale which ranges from 1 to 10. Postoperative pain of grade more than or equal to 2 was considered significant and was noticed on the first postoperative day and till the end of 1 week after the surgery. On postoperative day 1 all the patients in the suturing group (100%) and 3 in the autologous blood group complained of pain. On the next follow up on the 1st week 5 patients complained of pain in the suturing group

Table 1: Demographic distribution in study

Age in years	Number	Percentage
20 – 29	30	25
30 – 39	35	29.16
40 – 49	46	38.33
>/= 50	9	7.5
Gender		
Male	70	58
Female	50	42
Occupation		
Indoor	54	45
Outdoor	66	55
Site		
Nasal	107	89.1
Temporal	13	10.8
Co-morbidities		
Diabetics mellitus	14	13.33
Hypertension	16	15
Others	6	5.8

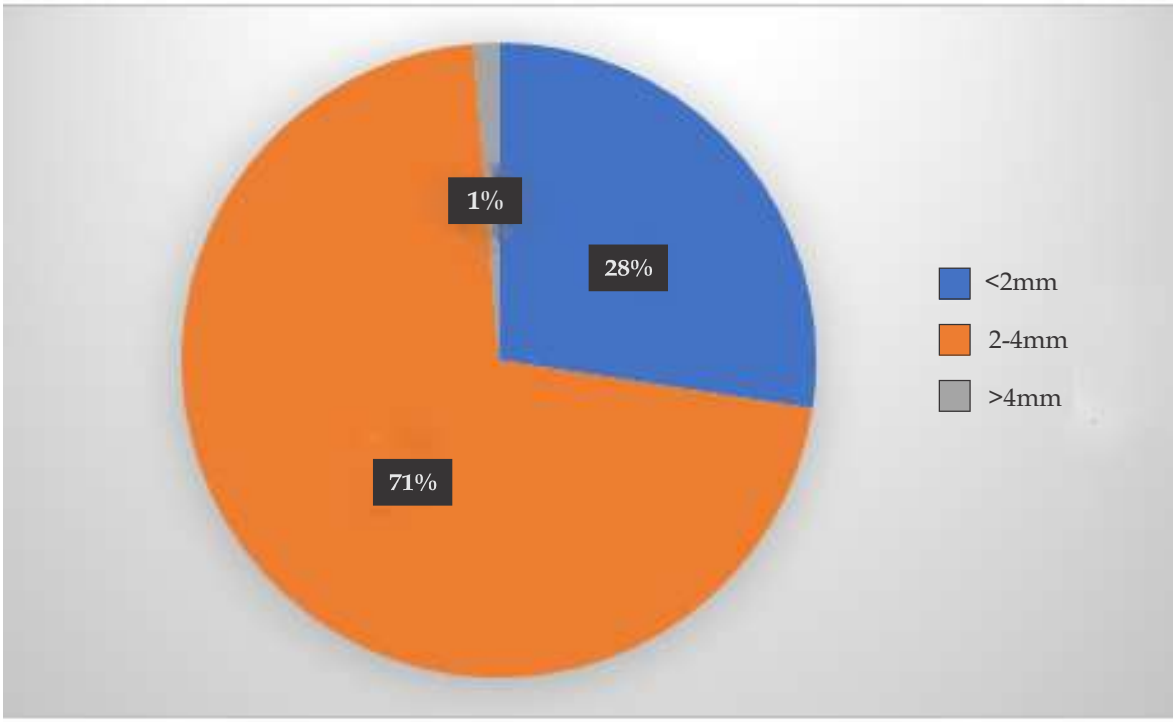

Fig.1: Distribution of the sample according to the corneal extension

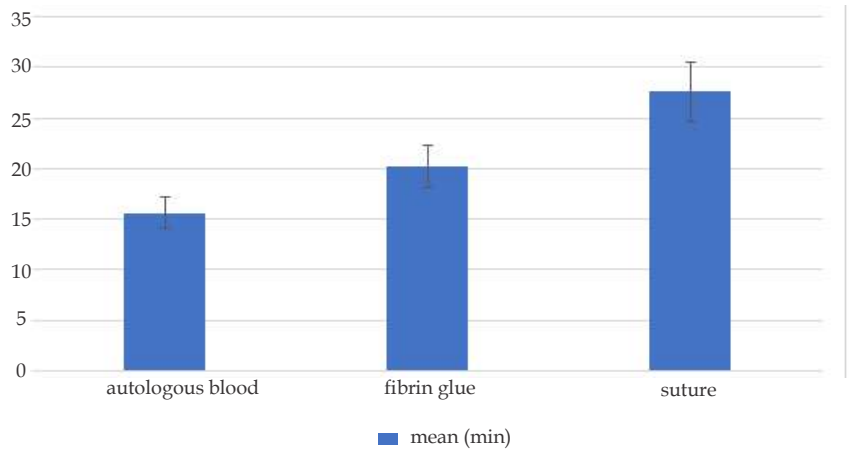

Fig. 2: Distribution of the sample according to time taken for the surgery.

and none in the group that had graft adhesion using autologous blood. No postoperative pain was noticed in the fibrin glue group. Watering was noticed in all 40 patients on the 1st postoperative day where sutures were used, in 7 patients where autologous blood was used and 8 patients where fibrin glue was used for graft adhesion. On the first follow up visit there was watering in 15 patients with suture. 7 with fibrin glue and none with autologous blood (Table 2).

Foreign body sensation was noticed on 1st postoperative day in all patients with suture, 36 patients with fibrin glue and 1 patient with autologous blood. On the next follow up it came down to 17 patients with sutures and 6 patients with the fibrin glue method (Table 3).

Table 2: Comparision of post operative pain on post operative day 1 and at the end of 1 week based on surgery

Surgery	Post operative pain (NO)		Post operative pain (YES)	
	Count	Percentage	Count	Percent
Post operative pain on post operative day 1 based on surgery				
Autologous blood	37	92.5	3	7.5
Fibrin glue	37	92.5	3	7.5
Suture	0	0	40	100
Post op pain at the end of 1 week based on surgery				
Autologous blood	40	100	0	0
Fibrin glue	39	97.5	1	2.5
Suture	35	87.5	5	12.5

Table 3: Comparision of foreign body sensation on post operative day 1 and at the end of 1 week based on surgery

Surgery	No (Foreign body sensation)		Yes (foreign body sensation)	
	Count	Percentage	Count	Percentage
Foreign body sensation on post operative day1 based on surgery				
Autologous blood	39	97.5	1	2.5
Fibrin glue	4	10	36	90
Suture	0	0	40	100
Foreign body sensation at the end of 1 week based on surgery				
Autologous blood	40	100	0	0
Fibrin glue	34	85	6	15
Suture	23	57.5	17	42.5

Table 4: Comparision of watering on post operative day 1 and at the end of 1 week based on surgery

Surgery	Watering (NO)		Watering (YES)	
	Count	Percent	Count	Percent
Watering on post operative day 1 based on surgery				
Autologous blood	33	82.5	7	17.5
Fibrin glue	32	80	8	20
Suture	0	0	40	100
Watering at the end of 1 week based on surgery				
Autologous blood	40	100	0	0
Fibrin glue	33	82.5	7	17.5
suture	25	62.5	15	

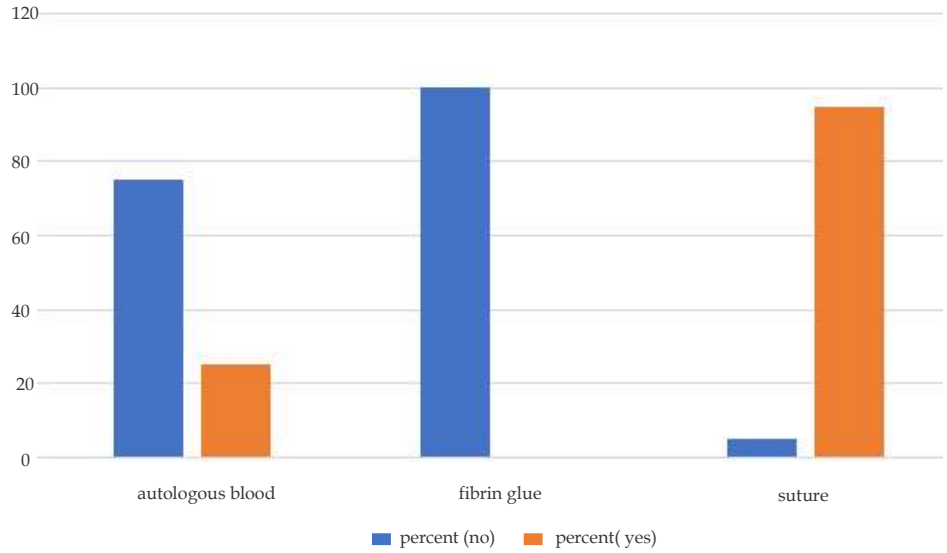

Fig. 3: Comparison of congestion on first postoperative day

Table 5: Comparison of SCH on first postoperative day

Surgery	SCH (NO)		SCH (YES)	
	Count	Percent	Count	Percent
Autologous blood	40	100	0	0
Fibrin glue	40	100	0	0
Suture	32	80	8	20

Table 6: Comparison of graft displacement

Surgery	Displacement (NO)		Displacement (YES)	
	Count	Percent	Count	Percent
Autologous blood	38	95	2	5
Fibrin glue	40	100	0	0
Suture	40	100	0	0

Table 7: Comparison of recurrence at 6 month post op based on surgery :

Surgery	Recurrence at 6 month (NO)		Recurrence at 6 month (YES)	
	Count	Percent	Count	Percent
Autologous blood	39	97.5	1	2.5
Fibrin glue	39	97.5	1	2.5
suture	39	97.5	1	2.5

Table 8: Effectiveness of autologous blood procedure on vision

Pre-op BCVA	Post – op BCVA					
	6/6–6/18		6/18–6/60		>6/60	
	Count	Percent	Count	Percent	Count	percent
Effectiveness of autologous blood procedure on vision						
6/6–6/18	34	100	0	0	0	0
6/18–6/60	0	0	4	100	0	0
>6/60	0	0	0	0	2	100
Effectiveness of fibrin glue procedure on vision						
6/6–6/18	32	100	0	0	0	0
6/18–6/60	0	0	6	100	0	0
>6/60	0	0	0	0	1	100
Effectiveness of suture procedure on vision						
6/6–6/18	38	100	0	0	0	0
6/18–6/60	0	0	1	100	0	0
>6/60	0	0	0	0	1	100

Congestion was noticed in 10 patients with autologous blood method, none with the fibrin glue method and 38 patients with suture. Subconjunctival hemorrhage was noticed only in 8 patients with sutures (Tables 4–8).

Discussion

A total of 120 patients who underwent pterygium excision with limbal conjunctival autograft were studied, of which 70 were males and 50 were females. 120 patients with 120 eyes underwent surgery. All are unilateral. In this study, most patients (38.3%) were more than 40 years old. Previous studies on Asian populations [2,3,4] have shown that prevalence of pterygium increases with age. The Beijing eye study [2] which was a population based prevalence study on a population of 4439 subjects showed that prevalence of pterygium is higher in people over 40 years of age($p>0.001$). The Tanjong Pagar Survey [3] results showed that pterygium prevalence increases linearly with age ($p<0.001$) and age is an independent risk factor with an Odds Ratio of 7.8 (95% CI) in those in the age group 70-81 years. The Tehran Eye study [4] on 4564 people observed an age standardized prevalence of 1.3% (95% CI).

A male preponderance was noticed in this study.The above mentioned studies [2,3,4] have also shown that the prevalence of pterygium is significantly higher in males. The Beijing eye study [2] observed that pterygium is significantly associated with male sex ($p = 0.04$). The Tanjong Pagar Survey [3] showed that prevalence of pterygium is more among men than women (age adjusted Odds Ratio 4.2, 95% CI) with the highest overall prevalence of 25.4% in men aged more than 70 years. In the Tehran Eye study [4] which was a cross-sectional population study pterygium prevalence was found to be more in males (1.4%) compared to females (1.1%), but no significant difference in the prevalence of pterygium were observed in a study by Bueno-Gimeno I *et al*. [5] where out of the 238 subjects with pterygium, 139 (58.4%) were males and 99 (41.6%) were females. A population based prevalence study of 1210 people aged 21 years and above conducted in Indonesia [6] showed slightly higher prevalence rate among females (17.6%) than males (16.1%).

In this study, the distribution of pterygium was found to be slightly higher in those working outdoors (55%) as compared to those working indoors (45%).Many studies have shown that pterygium is more prevalent in outdoor workers. Joan Khoo [7] *et al*. in their study on 38 outdoor workers and 148 indoor workers observed an increased prevalence of pterygium among the outdoor workers with an odds ratio of 7.0. A study in Jordanian population [8] showed a strong positive association of pterygium in those who worked outdoors with an odds ratio of 5.47.

A study by Rashima A *et al*. [9] has shown an increased prevalence of pterygium in rural population of South India which is due to their higher life time UV exposure. Though most of our patients are not working outdoors, the increased prevalence of pterygium in them can therefore be related to their high life time UV exposure. Of the total 120 pterygia, 107 were nasal (89.1%) and 13 were temporal (10.8%). Previous studies support this finding of increased incidence of nasal

pterygium compared to temporal. In a study by V. Dolezalova [10] on 1388 patients temporal pterygia were seen in only 33 cases. In another study by C SH Tan *et al*. [11] , majority had nasal pterygia (69 out of 81) of which 12 had both nasal and temporal pterygia.

The percentage distribution of pterygia was found to be similar in both right (18, 51.4%) and left (17, 48.6%) eyes. Similar results were observed in another study by C S H Tan *et al*. [11], where both eyes were affected equally (Right 85.2% 69/81 subjects, Left 86.4% 70/81 subjects). Considerable variation in bilaterality of pterygium had been observed among different studies. In the study by C S H Tan *et al*. [11] most of the subjects had involvement of both eyes (58 out of 81 subjects) while in another study G Gazzard *et al*. [12] bilateral pterygia were found in just 4.1% of their subjects.

This study graded the size of the pterygium based on its extension on to the corneal surface. Out of the 120 pterygia, 30 (27%) were small (< 2 mm), 12 (1%) were large (> 4mm) and 78 were medium sized (2–4 mm) ranging from 1 to 6mm and a mean of 2.61 mm (SD: 1.0). In a study by Mohammad-Salih *et al*. [13], pterygium extension ranged from 0.25mm to 6.5 mm and the mean extension was 2.0mm (SD: 1.2). Another study by Lin *et al*. [14] showed that corneal extension to within 3.2 mm of visual axis induces significant astigmatism, and therefore requires surgical management.

All these patients underwent pterygium excision with limbal conjunctival autografting and the grafts were secured using sutures or fibrin glue or autologous blood according to the patient's choice. Of the 120 eyes that underwent pterygium excision with limbal conjunctival autografting, the grafts were secured in 40 eyes (33.3%) using autologous blood, 40 eyes (33.3%) using sutures and 40 eyes (33.3%) using fibrin glue . The mean time taken for surgery in the various groups of this study was compared and found to be highest with sutures and least with the autologous blood method. The mean time taken for the fibrin glue group was 20.33 minutes (SD: 2.08).The mean time taken for the suture group was 27.7 min (SD: 2.93). The mean time taken for autologous blood method group was 15.70 min (SD: 1.54) which was less compared to other two groups.

A prospective randomized control trial on 50 patients comparing sutures and fibrin glue for graft adhesion by Reece C Hall Franzco *et al*. [15] showed shorter time for surgery in the fibrin glue group (12 minutes) compared to sutures (22 minutes).

One of the early randomized clinical trials comparing efficacies of fibrin glue and sutures for conjunctival graft adhesion by G Koranyi *et al*. [16] on 53 patients showed that the average time taken for the surgery is significantly higher for sutures (18.5 min) compared to fibrin glue (9.7 min).In the study of 15 eyes by D de Wit *et al*. [17] where autologous blood was used for graft adhesion the mean surgical time was 14 minutes (SD: 1.4).

A prospective randomized case control study by Singh PK *et al*. [18] compared the outcomes of conjunctival autograft adhesion using fibrin glue to that using blood clot in two groups of 10 patients each after pterygium excision. The mean duration of surgery in the fibrin glue group was 14.74 min (2.35) min which was less than that of the autologous blood group which was 17.45 (2.89) min. Increased mean surgical time in fibrin glue group of this study was due to the technical difficulties encountered during mixing of the glue in two of the three surgeries.

In this study no intraoperative complications were noticed. The significant postoperative complications noticed were postoperative pain, foreign body sensation, watering, congestion, subconjunctival hemorrhage and graft displacement. All the postoperative complications were noticed within 1 week of the surgery and they were fewer with fibrin glue and autologous blood compared to sutures. A randomized clinical trial by G Koranyi *et al*. [16] comparing efficacies of fibrin glue and sutures for conjunctival graft adhesion on 53 patients showed that postoperative pain was significantly higher for sutures but there was no correlation between postoperative pain and size of the pterygium.

Another comparative study of the efficacy and complications of fibrin glue and sutures by Harvey S *et al*. [19] showed similar results. They also found that postoperative complaints like pain, watering and foreign body sensation were less for fibrin glue compared to sutures. The same study found that 9% experienced subconjunctival hemorrhage while in this study there were 8.6% cases of SCH. There were no intraoperative or postoperative complications noted in the study by D de Wit *et al*. [17] of 15 eyes which underwent pterygium excision with graft adhesion using autologous blood.Minimal graft displacement was noticed in 1 eye in the autologous blood method group which did not require any revision surgery.

A prospective randomized control trial on 50 patients comparing sutures and dehiscence at first week in 1 patient in the glue group that required

revision of the graft. Harvey S *et al*. [19] in their study comparing efficacy and complications of sutures and fibrin glue observed partial graft dehiscence in 1 patient (9%) from the suture group. A prospective interventional case series by Malik KP *et al*. [20] in 40 eyes with primary nasal pterygium excision and graft adhesion using autologous blood showed graft dehiscence in 2 eyes, graft retraction in 3 eyes. A Karalezli *et al*. [21] in their prospective study comparing fibrin glue and sutures for graft adhesion in 50 eyes with primary pterygium noticed 2 partial graft dehiscence in fibrin glue group.

Singh PK *et al*. [22] in their study noticed graft retraction and graft displacement in 10% of the eyes that underwent graft adhesion with autologous blood compared to those with fibrin glue.

In this study no significant vision improvement was noticed irrespective of the method of graft adhesion. Effect of pterygium excision on visual acuity was studied on 36 patients by S Maheshwari [23] and observed visual improvement in 15 eyes (41.67%). The improvement was directly related to the size of the pterygium. Fong KS *et al*. [24] studied the refractive changes following pterygium surgery in 123 eyes and observed postoperative reversal of pterygium-induced astigmatism and the improvement correlated to the pterygium size as well.

Out of 120 eyes operated, only 3 eyes showed recurrence for the first 6 months after surgery in this study could be a significant finding as many previous studies have observed recurrences within 6 months time period.

G Koranyi *et al.* [16] in their randomized control trial observed 2 recurrences in the glue group (8%) and 4 in the suture group (20%). All of the recurrences were within 6 months' follow up and they occurred after 2–3 months. A prospective randomized control trial on 50 patients comparing sutures and fibrin glue for graft adhesion by Reece C Hall Franzco *et al*. [15] showed no recurrences in the glue group (0/24) and two recurrences in the suture group (2/23) after 3 months follow up. No further recurrences were noticed on the 6th month and 12months' follow ups.

M Fernandez *et al*. [25] studied the outcomes of different methods of pterygium surgery over 14 years and observed that recurrences after surgery were noted on an average of 6.0 (SD: 8.2) months for primary pterygia and an average of 3.1 (SD: 3.1) months for recurrent pterygia. However, they have found recurrences as late as 59.9 months. Prospective study comparing fibrin glue and sutures for graft adhesion in 50 eyes with primary pterygium by A Karalezli *et al*. [21] showed recurrence in 1 eye in fibrin glue group and 3 eyes with sutures after a follow up period of 12 months.

A prospective randomized case control study by Singh PK *et al*. [22] compared the outcomes of conjunctival autograft adhesion after pterygium excision using fibrin glue to that using blood clot in two groups of 10 patients each who were followed up for 12 months. However, the recurrence rates were identical (10%) in both groups.The study by D de Wit *et al*. [17] of 15 eyes which underwent pterygium excision with graft adhesion using autologous blood with a mean follow-up period of 9.2 (SD: 2.2) months, there were no recurrence.

A prospective interventional case series in 40 eyes with primary nasal pterygium using autologous blood for graft adhesion by Malik KP *et al*. [20] showed recurrence in 1 eye over a 12 month follow-up period.

Conclusion

The mean time taken for surgery in the various groups of this study was compared and found to be highest with sutures (27.7 min) and least with the autologous blood method (15.70 min). No intra op complications were noticed in the three groups. All patients were followed up for a period of 6 months. Postoperative complications were more with the use of sutures and mild enough to subside with treatment in 1 week.

Minimal graft displacement was noticed in 1 eye in the autologous blood method group which did not require any revision surgery. In this study single line improvement in postoperative Snellen's visual acuity was noticed in the three eyes with large pterygia unrelated to the method of graft adhesion. Recurrences were noticed in 3 of the 120 eyes over 6 months' follow up.

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Original Article

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Efficacy of HBOT in Central Retinal Artery Occlusion : Visual Outcome

Manoj Gupta

Abstract

Background: Visual loss is a major symptom in Central Retinal Artery Occlusion, while limited vision field has been described in Branched Retinal Artery Occlusion. Despite great developments in diagnostic, surgical and medical ophthalmology fields within recent years, retinal artery occlusion still remains a disease without approved therapy. Retinal cells consumed the highest oxygen consumption in organs, which makes the retina extremely susceptible to ischemia. *Aim and Objective:* The aim and objective of this prospective study was to look for effect of hyperbaric oxygen therapy and to evaluate and establish a possible marker for retinal damage. *Study Design:* Prospective case control study. *Place of Study:* The study was carried out at the Prana Hyper Baric Oxygen Therapy Centre, located in the Northern parts of Mumbai, in India. *Material and Method:* Total 62 patients with central retinal artery occlusion were included which were referred to our Prana hyperbaric center Mumbai over a period of three years. The HBO therapy protocol included 90 minutes oxygen breathing at 2 ata twice daily for 3 days and then followed by 1 OD for 4 days. *Results and Discussion:* The best corrected visual acuity [log MAR] after hyperbaric oxygen therapy compared with baseline showed a significant mean improvement of 0.612 ± 0.64 from 2.16 ± 0.48 to 1.58 ± 0.89 [p<0.0001]. similarly BCVA [log MAR] after HBOT in patients with cherry red spot compared with base line showed a mean improvement of 0.453 ± 0.358 from 2.24 ± 0.32 to 1.87 ± 0.54 [p < 0.0001] also showed a significant finding in non cherry red spot cases where BCVA after HBOT compared with base line showed a mean improvement of 0.78 ± 0.498 from 1.96 ± 0.68 to 1.21 ± 0.71 [p < 0.0001]. *Conclusion:* From clinical perspective hyperbaric oxygen therapy is an effective treatment for central retinal artery occlusion cases, it also concludes that the cherry red spot as marker of retinal infarction and as long as it is not being developed the prognosis appears to be good.

Keywords: Central Retinal Artery Occlusion; Hyperbaric Oxygen therapy; Cherry Red Spot.

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Introduction

Von Graefe 1859 was the first to describe central retinal artery occlusion due to embolism, since then it has been known as a clinical entity [1]. Later in 1864 it was described on opthalmoscopy by Schweigger [2]. From Internal carotid artery, ophthalmic artery originates and central retinal artery is a small but important branch of ophthalmic artery. Inner layer of retina gets it blood supply from central retinal artery and its branches [3]. Thrombosis, arteritis, embolus, vasospasm are the main aetiology of retinal artery occlusions [4]. The very consequences clinically are dramatic and treatment delay may cause blindness, retinal artery occlusion is much more common in hypertensive arteriosclerosis patients and also occasionally in patients with endocarditis [5,6]. Major symptom in central retinal artery occlusion is loss of vision, whereas limited vision field seen in branch retinal artery occlusion.

The ophthalmic artery originates from the internal carotid artery, and the central retinal artery is a small important branch of the ophthalmic artery. The blood supply of the inner layer of the retina comes from the Central Retinal Artery and its branches; occlusion of the branch leads to a branch retinal artery occlusion [3]. The etiology of Retinal Artery Occlusion includes thrombosis, embolus, arteritis, vasospasm [4]. Clinically, the consequences of this vascular accident are dramatic, and delayed treatment may lead to

Author Affiliation: Director, Prana Hyperbaric Oxygen Therapy Center, Borivali West, Mumbai, Maharashtra 400092, India.

Corresponding Author: Manoj Gupta. Sailee Hospital & Diagnostic Center, Prathamesh Horizon, New MHB Colony, New Link Road, Borivali West, Mumbai, Maharashtra 400091, India.

E-mail: drmanojgupta222@gmail.com

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blindness; Retinal Artery Occlusion is more common in hypertensive arteriosclerosis patients and occurs occasionally patients with endocarditis [5,6]. V isual loss is a major symptom in Central Retinal Artery Occlusion, while limited vision field has been described in Branched Retinal Artery Occlusion. Despite great developments in diagnostic, surgical and medical ophthalmology fields within recent years, retinal artery occlusion still remains a disease without approved therapy. Retinal cells consumed the highest oxygen consumption in organs, which makes the retina extremely susceptible to ischemia [7]. The inner retinal layers are normally supported by retinal circulation and typically lose viability, leading to vision loss.

In Animal studies it is clearly shown that total retinal ischemia can be entirely reversed provided the retina is reoxygenized within 97 minutes of onset of the symptoms [8]. In comparison to the animal studies in humans there is no clear timeline seen until irreversible anoxic retinal damage occurs. Few authors suggest elapsed time of around 6–6.5 hours [9] but this may be due to the large variability between patients, types of occlusion, and residual perfusion, such time frame is not considered to be reliable and hence different biologically based marker is required.

Central retinal artery occlusion an emergency eye situation that should be suspected in patient who presents with unilateral sudden painless vision loss, such patients usually had vision loss in the range of finger counting to light perception. Patients presenting with no light perception in the affected eye might had occluded the ophthalmic artery close to where it enters the eye which causes permanent and debilitating vision loss.

The proposed role for hyperbaric oxygen in Central Retinal Artery Occlusion is to increase the oxygen delivery to the ischemic tissue until spontaneous or assisted reperfusion occurs. Hyperbaric oxygen therapy includes the inhalation of 100% oxygen at pressures exceeding 1 atmosphere absolute (ATA) to enhance the amount of oxygen dissolved in the body tissues. During Hyperbaric oxygen therapy treatment arterial O_2 tension typically exceeds 2,000 mm Hg [10]. The aim and objective of this prospective study was to look for effect of hyperbaric oxygen therapy and to evaluate and establish a possible marker for retinal damage which included cases of non arteritic central retinal artery occlusion patients.

Materials and Methods

Study Setting

The study was carried out at the Prana Hyper Baric Oxygen Therapy Centre, which is owned by the Investigator and located in the Northern parts of Mumbai, in India. The center has one Sechrist Monoplace hyperbaric chamber and a TCOM machine with 3 electrodes. The oxygen gas supply is from oxygen cylinders of 7000 liters' capacity each. The center has all the requisite certifications and registrations as required by the local authority in Mumbai. Study was conducted over a period of 3 years and patient with Central retinal artery occlusion referred to the Hyperbaric Unit at Prana HBO center. Center took care in a specialized form and provided care to patients with central retinal artery occlusive conditions and was responsible for caring for all patients. Written informed consent was obtained from the patient and patient's relative.

Study Design

Study carried out was prospective case control study.

Study Population

In our study total 62 patients with central retinal artery occlusion were included which were referred to our Prana hyperbaric center Mumbai over a period of three years. Furthermore all the patients were screened for eligibility to be included in the study

Inclusion Criteria

Patients referred to Prana Hyperbaric center, with age more than 18 years non arteritic central retinal artery occlusion with symptoms not more than 20 hours and best corrected visual acuity worse than 0.5 logarithm of minimum angle of resolution [log MAR] were included in the study.

Exclusion Criteria

All of the following patients who discontinued therapy during the treatment, with excessive best corrected visual acuity more than 0.5 log Mar, arteritic central retinal artery occlusion, patent cilio retinal artery, other final diagnosis and branch retinal artery occlusion cases were excluded from the study.

Ethics Review

This study was performed within the scope of international ethical guidelines and legislation. Ethics review and approval was provided by Stellenbosch University (number: U16/06/015) and the ethics committee of the Hyperbaric Society in India.

Procedure

In our study the patients with suspected central retinal artery occlusion were included and treated with hyperbaric oxygen therapy for retinal artery occlusion. The HBO therapy protocol included 90 minutes oxygen breathing at 2 ata twice daily for 3 days and then followed by 1 OD for 4 days. During the course of recruitment of the patients for the study detailed neurologic and cardiologic examinations were done while hospitalization to establish the cause of occlusion in such cases. Echocardiography, duplex ultrasound of the carotid arteries was also performed as a part of the investigation during inclusion of the patients. All the safety precautions of hyperbaric oxygen therapy in regards with adverse reactions were meticulously monitored and analyzed.

Statistical Analysis

Numerical Data Present in graphically and descriptive statistics like mean, standard deviation, confidence interval etc. done on numeric variables. A large sample t-test was performed on numerical data. Correlation analysis to measure the relation between variable which was performed on change in BCVA and Treatment time from symptoms to treatment and chi square test was performed to check the significance. Regression analysis was used. All statistical analysis was done by using the Statistical package for the Social Science [SPSS] V.19 software.

Results

In our prospective case control study total 62 patients were enrolled who fulfilled the inclusion criterion and were included for the final analysis of the study. 10 cases were excluded from the study due to the time delay of more than 20 hours for treatment but were separately analyzed for best corrected visual acuity pointed and highlighted in Figure 3 of the study. In our study mean age of the patients was 65.3 ± 11.8 years and out of the total 62 cases 44 patients were males (Table 1). The most prevalent chronic medical conditions were hypertension followed by hypercholesterolemia and active smoking with 38, 28 and 21 cases respectively involved. Out of that 22 cases were on treatment with statins prior to the central retinal artery occlusion event. In our study the mean time delay from onset of symptoms to actual starting of the treatment for CRAO event was 7.3 ± 4.1 hours. The average number of hyperbaric oxygen therapy sessions was 3.9 ± 1.4. In our study right eye was affected in 27 cases whereas left eye was involved in 35 cases. The intra ocular pressure was 13.4 ± 3.9 mmHg. 40 patients presented with cherry red spot in the study. The best corrected visual acuity [log MAR] after hyperbaric oxygen therapy compared with baseline showed a significant mean improvement of 0.612 ± 0.64 from 2.16 ± 0.48 to 1.58 ± 0.89 [p<0.0001]. similarly BCVA [log MAR] after HBOT in patients with cherry red spot compared with base line showed a mean improvement of 0.453 ± 0.358 from 2.24 ± 0.32 to 1.87 ± 0.54 [p<0.0001] also showed a significant finding in non cherry red spot cases where BCVA after HBOT compared with base line showed a mean improvement of 0.78 ± 0.498 from 1.96 ± 0.68 to 1.21 ± 0.71 [p<0.0001]. (Table 2) (Fig. 3). The visual outcome of the patients with delayed presentation for treatment i.e. more than 20 hours from onset of symptoms is being displayed in Table 3. It was found that the presence of plaque or boxcarrying during fundus examination had no effect on visual outcome in the study. In the present study no patients had any episodes of major adverse events, few minor events were observed in 2 patients experienced with otalgia without barotruma signs, none of the cases need to be intervened by any procedures to continue HBOT.

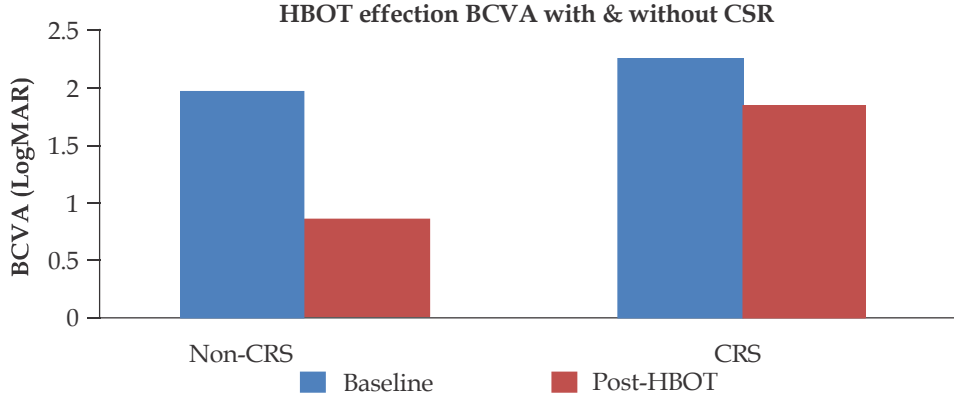

Fig. 1: Hyperbaric oxygen therapy effects on BCVA in patients with and without cherry red spots.

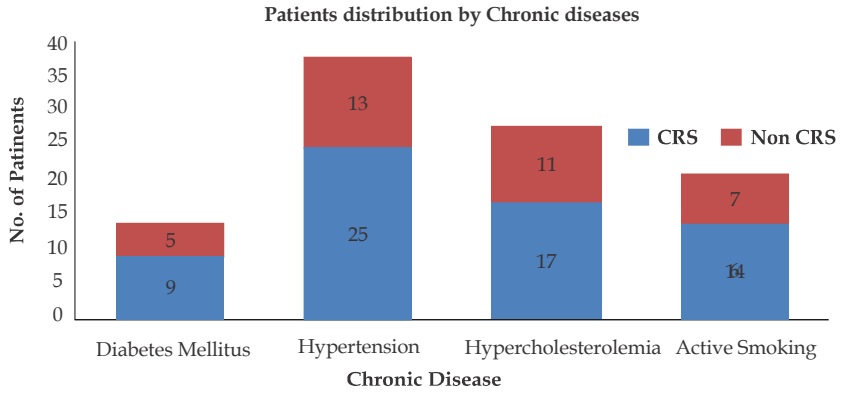

Fig. 2: Patient distributions by chronic diseases

Table 1: Patient's baseline characteristics

Characteristics	HBOT	CRS	Non – CRS	Significance
Male	44	29	15	
Female	18	11	07	
Age	65.3 ± 11.8	66.14 ± 12.2	64.2 ± 11.3	0.00315
Chronic Medical Condition:				
Diabetes Mellitus	14	09	05	
Hypertension	38	25	13	
Hypercholesterolemia	28	17	11	
Active Smoking	21	14	07	
Chronic Medications:				
Statins	22	14	08	
Involved Eye:				
Right	27	18	09	
Left	35	22	13	
Time from symptoms to treatment	7.3 ± 4.1 (1-20)	7.9 ± 4.3 (2-19)	6.9 ± 3.9 (1-20)	0.0000211
Intraocular Pressure	13.4 ± 3.9	12.9 ± 3.4	14.1 ± 4.5	0.00001
Fundus Finding:				
Plaque	14	08	06	
CRS	40	-	-	
Boxcarring	12	07	05	
Number of HBOT sessions:				
Median = 3.9	3.9 ± 1.4	4 ± 1.1	3.8 ± 1	0.0021

Table 2: Analysis of best corrected visual acuity

Outcomes	All Patients (n= 62)	CRS (n= 40)	Non – CRS (n= 22)	Significance
Baseline Log MAR	2.16 ± 0.48	2.24 ± 0.32	1.96 ± 0.68	0.00002
Discharge log MAR	1.58 ± 0.89	1.87 ± 0.54	1.21 ± 0.71	0.0001
Change in log MAR	0.612 ± 0.64	0.453 ± 0.358	0.78 ± 0.498	0.0001
Clinical significant usual improvement ≥0.3 log MAR	42	23	19	0.00001
Log MAR ≤ 1	16	3	13	0.0001

Discussion

In our present study we evaluated therapeutic effect of hyperbaric oxygen in patients suffering from non arteritic central retinal artery occlusion. There are various studies, case reports and cohort studies that had shown the very efficacy of using hyperbaric oxygen in patients with retinal artery occlusion in various time frames [11–15]. But

Table 3: Analysis of BCVA for patients with time delay of over 20 hours

Outcomes	All Patients (n= 10)	CRS (n= 07)	Non – CRS (n= 03)	Significance
Baseline Log MAR	2.01 ± 0.52	2.04 ± 0.42	1.98 ± 0.51	0.8612
Discharge log MAR	1.84 ± 0.89	2.16 ± 0.55	1.65 ± 0.68	0.061
Change in log MAR	0.421 ± 0.694	0.124 ± 0.242	0.684 ± 0.389	0.135
Clinical significant usual improvement ≥ 0.3 log MAR	4	1	3	0.123
Log MAR ≤ 1	5	2	3	0.315

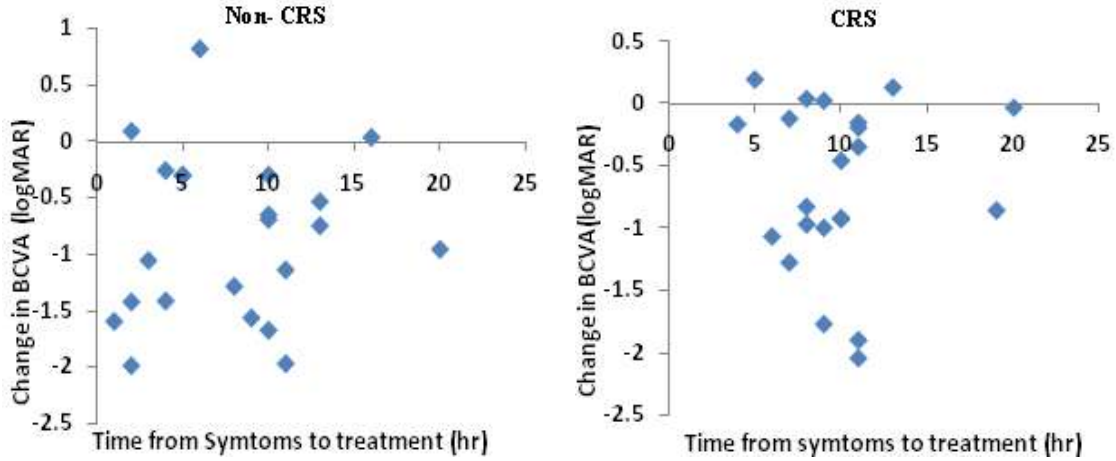

Fig. 3: Change in BCVA post HBOT and time delay to treatment as a factor.

the point to highlight was that many cases were from branched retinal artery occlusion, arteritic retinal occlusion or central retinal artery occlusion. Near related causes of retinal arterial occlusive diseases includes atherosclerosis related thrombus, embolism, vasospasm and giant cell arteritis. Central retinal artery occlusion with significant loss of vision is considered as ophthalmic emergency, treatment should be aimed at prompt supply of oxygen to ischemic retina at a partial pressure which is sufficient to maintain viability during medically assisted or spontaneous restoration of central retinal artery blood flow is established. In Animal model research of retinal artery injury have shown a reduction in apoptosis from 58% of cell loss to 30% in animals treated with hyperbaric oxygen [16].

The retinal tissue undergoes a period of ischemia when retinal arterial flow is interrupted, blood flow is usually re-established via re-canalization but if hypoxia and ischemia resulted in cell death and necrosis in the inner layers of the retina, vision may not return even if the blood flow is re-established. Ischemic Penumbra is a term used when tissue that is ischemic yet capable of recovery within a certain time frame [17]. In the study reported by Stone et. al. two patients with CRAo of more than six hours duration were treated with intermittent carbogen i.e. 95% oxygen and 5 % CO_2, retrobulbar anesthesia and anterior chamber paracentesis. In his study the first patient vision improved from hand motion to 20/20 due to the above mentioned therapy, wherein the carbogen was being administered for every 10 minutes every hour, on the contrary the second patient had improvement from finger counting to 20/25 where the carbogen was administered 10 minutes every hour for 48 hours [18].

In the study reported by Hertoz *et. al.* 17 patients with central retinal artery occlusion were treated with HBOT, he divided the patient into four groups based on the time to onset of treatment and highlighted the HBO_2 seemed useful in preserving visual function when the therapy was given within eight hours from the onset of visual impairment [19].

In the present prospective case control study we evaluated the therapeutic effect of hyperbaric oxygen in patients referred to our Prana hyperbaric center suffering from acute central retinal artery occlusion, the important predictor in the study was no cherry red spot at fundus examination, the improvement in patient without cherry red spot

was significant that is 19 patients gaining clinical improvement [log MAR change ≥0.3] and 13 patients gaining best corrected visual acuity ≤1 log MAR making the basis to this finding it was concluded that cherry red spot can serve as marker for irreversible anoxic retinal damage to be used for patients for hyperbaric oxygen therapy, as well it can be used in future studies designed to evaluate different interventions aiming to reverse retinal ischemia. However, in our study there was no control group, as such it is not possible to have due to ethical reasons also central retinal artery occlusion is approved indication for hyperbaric oxygen therapy, since the visual improvement occurred quite dramatic within minutes after the target treatment pressure was obtained when the patient was in chamber as well then there was not any improvement until hyperbaric oxygen therapy session started, it can be concluded that the improvement in vision is related to increased retinal oxygenation with hyper baric oxygen.

Conclusion

From clinical perspective hyperbaric oxygen therapy is an effective treatment for central retinal artery occlusion cases, it also concludes that the cherry red spot as marker of retinal infarction and as long as it is not being developed the prognosis appears to be good. Hyperbaric oxygen therapy is a safe and non invasive intervention that should be considered with priority in central retinal artery occlusion patients. The fundus findings should be considered as an important marker to look for the outcome of treatment success.

Conflict of Interest: The author declares no conflict of interest for this study.

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Original Article

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Evaluation of Ocular Manifestations in HIV/AIDS Patients on HAART in a Tertiary Care Hospital in Southern India : A Cross Sectional Study

Damdamraju Murali Krishna[1], Cheedella Sandhya S[2], Gajjala Vijay Bhaskar MS[3]

Abstract

Human immunodeficiency virus (HIV)/Acquired immune deficiency syndrome (AIDS) is one of the most feared infectious diseases of the late 20th century with Indian estimates of 21.17 lakhs patients living with HIV contributing to highest numbers among the world . Ocular disease continues to be a major cause of morbidity, among HIV-infected population.Introduction of Highly active antiretroviral therapy (HAART) in India led to a dramatic reduction in ocular morbidity . There are only few studies in Indian sub-continent that have evaluated the prevalence of HIV related ocular lesions in patients on HAART. The Purpose of presentstudy is to evaluate ocular manifestations in patients on HAART in a tertiary care hospital. *Context: Aims:* To study the ocular manifestations among HIV patients on HAART To study the relationship between ocular findings and the duration of HAART *Settings and Design:* observational study was done in the Anti Retroviral Therapy (ART) centre, Sri Ram Narayan Ruia Government General Hospital (SVRRGGH) attached to Sri Venkateswara Medical college (SVMC), Tirupati between November 2013 to September 2017. The study was approved by the Institutional ethic committee of the Institution. *Methods and Material:* 1026 HIV positive patients who are on HAART fulfilling the inclusion criteria were examined as per protocol and results were analyzed *Statistical analysis used:* SPSS 13 *Results:* 1026 HIV positive patients on HAART were examined during study period out of which 221 (21.53%) patients had ocular manifestations. incidence of ocular manifestations was higher in males compared to females (57.02% vs. 42.98%). The commonest ocular manifestation was HIV retinopathy (14.2%). New manifestations observed were presenile cataract (9.50%). Iatrogenic manifestations observed were Immune recovery uveitis (3.61%), anaemic retinopathy (9.95%). *Conclusions:* Our study evaluated the prevalence of ocular manifestations in HIV-infected patients on HAART. Screening this patient population is of particular importantance not only because of the high prevalence of ocular manifestations due to disease but also due to the potential for worsening of ocular conditions due to HAART induced IRIS and anemic retinopathy. This shows the importance of ophthalmic evaluation of all HIV patients on HAART.

Keywords: Human Immunodeficiency Virus (HIV); Highly Active Antiretroviral Therapy (HAART); Cytomegalovirus Retinitis (CMV); Cluster of Differentiation 4 (CD4) Cells, HIV Retinopathy; Immune Reconstitution Inflammatory Syndrome (IRIS)

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Introduction

Human immunodeficiency virus (HIV)/ Acquired immune deficiency syndrome (AIDS) is one of the most feared infectious diseases of the late 20th century [1]. Ocular manifestations of HIV/ AIDS are very common and can be the presenting sign of an underlying systemic infection in an otherwise asymptomatic HIV positive patient. Ocular disease continues to be a major cause of morbidity, which may affect 50-75% of HIV-infected people worldwide at some point during the course of their illness [2]. The disease can affect any of the ocular tissues, from eye lids to the retina and ocular adnexa. Low socio economic patients typically start Highly active antiretroviral

Author Affiliation: [1]Associate Professor, [2]Professor & Head, [3]Senior Resident, Department of Ophthalmology, Sri Venkateswara Medical College, Tirupati, Andhra Pradesh 517507, India.

Corresponding Author: Cheedella Sandhya S, Professor & Head Department of Ophthalmology, Sri Venkateswara Medical College, Tirupati, Andhra Pradesh 517507, India.

E-mail: cheedella.sandhya@gmail.com

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therapy (HART) at low cluster of differentiation 4 (CD4) cells count and may be at high risk of ocular opportunistic infections. In addition the causes of ocular morbidity may include HIV retinopathy, immune recovery uveitis after HAART initiation, drug induced anaemic retinopathy and ischemic maculopathy. Identification and treatment of this is important to prevent further progression of disease and morbidity.

Highly active antiretroviral therapy (HAART) has changed the face of HIV acquired immune deficiency syndrome (AIDS) by leading to dramatic decrease in HIV-related morbidity and mortality in the developed as well as developing world [3,4]. Introduction of generic HAART in India has led to a dramatic reduction in the incidence of opportunistic infections particularly CMV retinitis by around 87 %. India has the third highest number of estimated people living with HIV in the world. According to the HIV estimations 2015, the estimated number of people living with HIV/AIDS in India was 21.17 lakhs of which undivided Andhra Pradesh has a share of 3.95 lakhs [5].

Ocular manifestations of HIV in India was first reported in 1995. The estimated prevalence of HIV-related eye disease in India is reported to be between 8-45% [6]. Data are scarce concerning the burden of ocular disease in patients on HAART therapy. Most of the estimates till now are based on symptoms or Ophthalmological referrals. The ART centre located in SVRRGG Hospital, Tirupati, Andhra Pradesh, India has about 14,000 of registered patients and the previous statistics showed that very small percentage of them seeks advice for ophthalmic problems. In view of paucity of data available on HIV related ocular manifestations, the present work aims at evaluating the ophthalmic problems in this area. This also helps in educating and treat the patients having eye problems.

Aims and Objectives

- To study the ocular manifestations among HIV patients on HAART
- To study the relationship between ocular findings and the duration of HAART

Materials and Methods

This cross sectional observational study was done in the ART centre, Sri Venkateswara Ramnarain Ruia Government General Hospital, Tirupati, India from November 2013 to September 2017. HIV positive patients on HAART attending ART centre were included in this study. The study was approved by the Institutional ethics committee of Sri Venkateswara Ramnarain Ruia Government General Hospital and S V Medical College, Tirupati. 1026 HIV positive patients on HAART were included in the study. Patients who were not on HAART known to have ocular manifestations before being diagnosed as HIV infected and patients not willing to participate in this study were excluded from the study.

After obtaining written and informed consent a detailed history was taken from all the patients. Information on the antiretroviral regimen, WHO clinical staging of HIV infection, the length of time since initiating the HAART was obtained from the patient's records at ART center.

A detailed ophthalmic examination was carried out in all patients irrespective of ocular symptoms. Visual Acuity was recorded with Snellen's chart, Slit lamp examination, and direct ophthalmoscopic examination was done for all patients. Gonioscopy, Indirect ophthalmoscopy was done in required cases.

Patients presenting primarily with ophthalmic findings or complaints were managed by the ophthalmologists based on the clinical diagnosis. The results were analysed statistically. Data were analyzed using SPSS version 13 software and $p < 0.05$ was considered significant.

Results

An observational clinical study with 1026 HIV positive patients on HAART was undertaken to study the incidence of ocular manifestations in relation to HAART. 1026 HIV positive patients on HAART were examined during study period out of which 221 patients had ocular manifestations. A thorough ophthalmic workup was done in all patients included in the study. In the present study, maximum incidence was found in age group of 21–40 years amounting to 46.60%. Out of 221 patients 103 patients were in the income earning and sexually active age group (Table 1).

Table 1: Age distribution of patients with ocular manifestations

Age in years	Number of patients	% (Percentage)
0–20	14	6.33
21–40	103	46.60
41–60	76	34.38
>60	28	12.66

The incidence of ocular manifestations was higher in males compared to females (57.02% vs. 42.98%) the male: female ratio was 1.32:1.166 pateints belongs to rural (75.11%) area and 55 patents belong to urban area (24.88%) (Table 2). In the present study, the incidence of ocular manifestations was higher in males compared to females (57.02% vs. 42.98%) the male: female ratio was 1.32:1.166 pateints belongs to rural (75.11%) area and 55 patents belong to urban area (24.88%)

Table 2: Gender distribution of patients with ocular manifestations

Gender	Number of patients	% (Percentage)
Male	126	57.02%
Female	95	42.98%
Total	221	100

In the present study more number of patients with ocular manifestations was from rural area.

Table 3: Distribution of patients with ocular manifestations based on duration of HAART

Months since HAART started	Number of patients	% (Percentage)
<12	11	4.97
13–24	52	23.07
25–60	150	67.87
>60	8	3.61

HAART: Highly Active Anti Retroviral Therapy

Nearly 73% of patients were on HAART therapy for more than 2 years (67.87% between 25-60 months range and 4.97% more than 60 months). (Table 3). In the present study 31 patients (14.02%) had HIV retinopathy, which is the most common manifestation (Fig. 1). In opportunistic infections CMV retinitis was the most common manifestation seen in 10 (4.52%) patients (Fig. 2A, B). Other opportunistic infections observed were herpes simplex keratitis (4.07%), herpes zoster Ophthalmicus (1.35%), fungal keratitis (3.1%) and choroiditis (3.16%). In Drug related manifestations Anemic retinopathy was seen in 22 patients (9.95%) (Fig. 3A, B) and Immune recovery uveitis was seen in 8 patients (3.61%). Conjunctivitis and Blepharitis was seen in 23 patients (10.40%) and 22 patients (9.95%) respectively. Pre senile cataract was seen in 21 patients (9.50%) and 17 patients (7.69%) had Iridocyclitis. Neuroophthalmic manifestations like Optic atrophy (2.26%), Papilloedema (1.80%) was also observed. Retinal detachment was seen in 4 patients (1.80%). Other manifestations were External Hardeolum (2.26%) and Dry eye (8.59%). (Table 4).

Table 4: Types of ocular manifestations

Ocular Manifestations	Number of patients	% (Percentage)
Blepharitis	22	9.95
Conjunctivitis	23	10.40
Dry eye	19	8.59
Herpes simplex keratitis	9	4.07
Herpes zoster Ophthalmicus	3	1.35
Fungal corneal ulcer	7	3.1
IRU	8	3.61
Pre senile cataract	21	9.50
Iridocyclitis	17	7.69
Nerve palsy	4	1.80
Hardeolumexternum	5	2.26
HIV retinopathy	31	14.02
CMV retinitis	10	4.52
Retinal detachment	4	1.80
Anaemic retinopathy	22	9.95
Choroiditis	7	3.16
Optic atrophy	5	2.26
Papilloedema	4	1.80

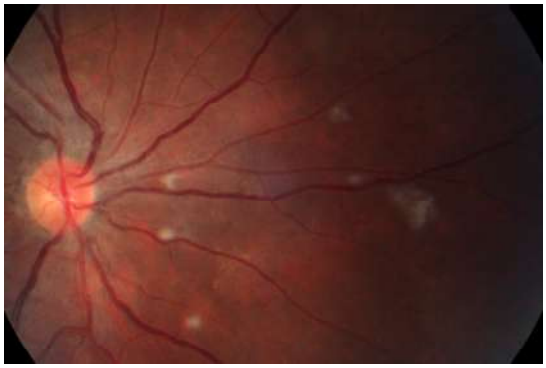
IRU: Immune related uveitis

CMV retinitis: CytoMegalo Virus retinitis

HIV retinopathy: Human Immunodeficiency Virus retinopathy

The distribution of ocular manifestations based on duration of HAART was grouped in to four categories and analysed statistically. In that Immune recovery uveitis ($p \leq 0.001$) and CMV retinitis ($p \leq 0.001$) were statistically significant (Table 5). Patients on HAART for less than 12 months were included in the first category in which CMV retinitis and IRU were seen in 36.36% of patients each.

Retinal detachment was observed in 18.18% patients and choroiditis was observed in 9.09% patients. In second category (Duration of HAART between 13–24 months) Iridocyclitis was the most common manifestation. More number of patients included in third category (Duration of HAART between 25–60 months). Conjunctivitis (13.92%) was the most common manifestation followed by Blepharitis (12.65%), HIV retinopathy (12.65%), Pre senile cataract (10.75%), Dry eye (10.75%) and Anaemic retinopathy (10.12%). In fourth category (Duration of HAART > 60 months) HIV retinopathy was the most common manifestation (37.5%) followed by Anaemic retinopathy (25%) (Table 5).



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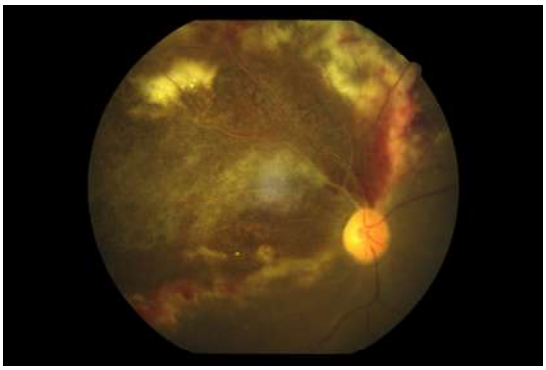

Fig. 2A:

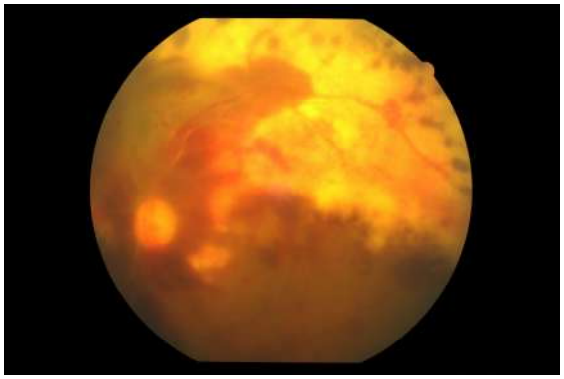

Fig. 2B:

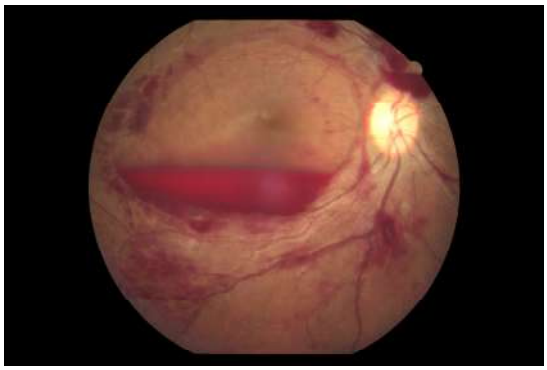

Fig. 3A:

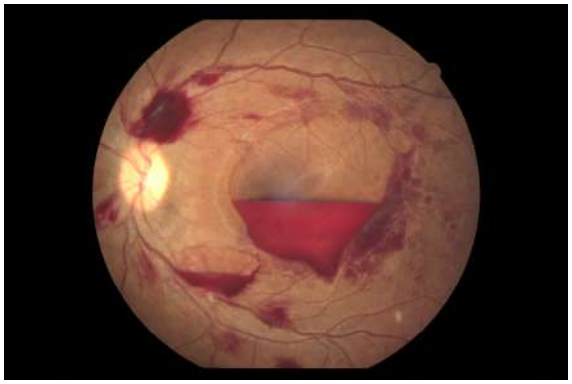

Fig. 3B:

Discussion

Ophthalmic manifestations of HIV and AIDS in a region depend on several factors like availability of healthcare, regional variation in disease patterns, etc. In the present study, out of 1026 patients with HIV on HAART, 221 patients had ocular manifestations. In present study 21.53% patients had ocular manifestations, which is in concordance with the study which was conducted by Bennet Amare *et al*.(7) whereas the study done by Gharai S, venkatesh P *et al*., Biswas J et al showed a higher incidence of ocular manifestations (8)(6). The reduced incidence of ocular involvement in present study and study conducted by Bennet Amare *et al*. can be attributed to effective HAART therapy because in both studies study sample was taken from patients who were on HAART therapy. In our study (57.02%) affected patients were males, 95 (42.98%) patients were females with a male to female ratio was 1.32:1similar to YaredAseefa *et al*. and Lamichanne *et al*. (9)(10). Majority of the patients (46.60%) were in the age group of 21-40 years followed by 34.38% patients in the age group of 41-60 years which shows economic burden on the society. In present study HIV retinopathy was the

Table 5: Association of ocular manifestations according to duration of HAART

Manifestations	Duration of HAART in months				p- value
	<12 (n=11)	13–24 (n=52)	25–60 (n=150)	>60 (n=8)	
Blepharitis	0 (0%)	1 (1.92%)	20 (12.65%)	1 (12.5%)	0.018
Conjunctivitis	0 (0%)	1 (1.92%)	22 (13.92%)	0 (0%)	0.014
Dry eye	0 (0%)	2 (3.84%)	17 (10.75%)	0 (0%)	0.121
Herpes simplex keratitis	0 (0%)	2 (3.84%)	6 (3.79%)	1 (12.5%)	0.961
Herpes zoster Ophthalmicus	0 (0%)	0 (0%)	3 (1.89%)	0 (0%)	0.647
Fungal corneal ulcer	0 (0%)	2 (3.84%)	4 (2.53%)	1 (12.5%)	0.673
IRU	4 (36.36%)	4 (7.69%)	0 (0%)	0 (0%)	<0.001
Pre senile cataract	0 (0%)	4 (7.69%)	17 (10.75%)	0 (0%)	0.45
Iridocyclitis	0 (0%)	9 (17.30%)	8 (5.06%)	0 (0%)	0.04
Nerve palsy	0 (0%)	3 (5.76%)	1 (0.63%)	0 (0%)	0.13
Hardeolumexternum	0 (0%)	3 (5.76%)	2 (1.26%)	0 (0%)	0.28
HIV retinopathy	0 (0%)	8 (15.38%)	20 (12.65%)	3 (37.5%)	0.89
CMV retinitis	4 (36.36%)	4 (7.69%)	2 (1.26%)	0 (0%)	<0.001
Retinal detachment	2 (18.18%)	2 (3.84%)	0 (0%)	0 (0%)	0.008
Anaemic retinopathy	0 (0%)	4 (7.69%)	16 (10.12%)	2 (25%)	0.378
Choroiditis	1 (9.09%)	3 (5.76%)	3 (1.89%)	0 (0%)	0.20
Optic atrophy	0 (0%)	0 (0%)	5 (3.16%)	0 (0%)	0.354
Papilloedema	0 (0%)	0 (0%)	4 (2.53%)	0 (0%)	0.474

most common ocular manifestation. This was seen in 14.02% of patients with ocular manifestations. HIV retinopathy was also one of the most common ocular manifestations in the studies conducted by Gharai S *et al*. (11%) and Pavanakrishnaraja acharya *et al*. (13%) [8,11]. Studies conducted by Yaredaseefa *et al*. and Lamichhane G *et al*. showed higher incidence of HIV retinopathy.This may be due to the fact that all patients are on HAART with a consequent decrease in the viral load. Similarly CMV retinitis also decreased (4.5%) compared to the above said studies. The incidence of HZO in present study was 1.35%. this was lesser compared to studies conducted by Gharai S *et al*., Yaredaseefa *et al.* and Vidyaranirajkumari *et al.* [8,9,12]. Presenile cataract was seen in 9.5% of patients. All 9.5% of patients proved negative for other causes of pre senile cataract. Previous studies have not shown presenile cataract as an ocular manifestation of HIV/AIDS or complication of HAART. A prospective cohort study was conducted by John H. Kempen *et al.* to evaluate the risk of cataract in the setting of AIDS. The incidence of cataract in that study was 0.37%/eye-year [13]. Thorne *et al.* (2006) showed that cataract was one of the common causes of loss of visual acuity, primarily in patients with HAART induced immune recovery [14]. Anaemic retinopathy was observed in 9.95% of the patients. In previous studies only Sridharan sudharsan *et al.* mentioned Anaemic retinopathy as ocular manifestation and they observed only in 0.73% of the patients [15]. The cause of anemic retinopathy might be due to prolonged Zidovudine therapy.

Anterior uveitis was seen in 7.69% of patientswhich was close to Yaredaseefa *et al.* study. Immune recovery uveitis was seen in 3.61% of patients.Yaredaseefa *et al.* and Gharai S *et al.* studies showed 5% incidence of Immune recovery uveitis. Sridharan sudharsan *et al.* (6.28%) study observed 17.4% of incidence of Immune recovery uveitis [8,9,15].

Blepharitis was seen in 9.95%, Conjunctivitis was seen in 10.4% and Dry eye was seen in 8.59% of the patients with ocular manifestations.In present study these manifestations had no statistical significance. Kaposi's sarcoma was not seen in the present study which might be due to low prevalence of AIDS-related malignancies in South Asia, and is thought to be due to low prevalence of human herpes virus-in this population.

In present study the effect of the duration of disease on ocular manifestations was divided into four categories. Present study showed direct correlation between duration of disease and ocular manifestations. In first category (duration of HIV <12 months) 12.8% of the patients showed ocular

involvement. In second category 16.75%, in third category 26.48% and in fourth category 24.13% had ocular manifestations. More number of patients were in third and fourth categories. The association between ocular manifestations and duration of the disease was statistically significant. (p = 0.0006). The duration of the disease also may be an important predictor of the presence of HIV-related eye diseases. (Table 6)

Table 6: Correlation between ocular manifestations and duration of disease

Months since HIV diagnosis	With manifestations	Without manifestations	p-value
<12 (n=78)	10	68	
13–24 (n=336)	54	282	0.0006
25–60 (n=540)	143	397	
>60 (n=72)	14	58	

A different association was observed between ocular manifestations and duration of HAART therapy. This might be due to effect of HAART on HIV related ocular manifestations and effect of HAART on eye. The incidence of ocular manifestations like Immune recovery uveitis which was due to effect of HAART therapy was observed more in early months of the therapy. Anemic retinopathy which was another manifestation supposedly due to Zidovudine therapy was observed a few months after initiation of HAART therapy. All Immune recovery uveitis patients (8 patients) were on HAART therapy for less than two years only. Of patients with anemic retinopathy almost 82% were on HAART for more than two years. The incidence of CMV retinitis decreased with increased duration of HAART.

The association of duration of HAART and ocular manifestations was statistically insignificant (P:0.375). This may be due to the protective effect of HAART from systemic disease and all the patients in the study group were on HAART (Table 7).

Table 7: Correlation between manifestations and Duration of HAART

Months since ART started	With manifestations	Without manifestations	P-value
<12 (n=53)	11	42	
13–24 (n=274)	52	222	0.375
25–60 (n=648)	150	498	
>60 (n=51)	8	43	

Conclusion

HIV/AIDS is one of the new diseases afflicting mankind, which was virtually unknown 30 years ago. Today more than 34 million people are living worldwide with HIV/AIDS. In this population about 50–80% patients have ocular manifestations at some point during the course of illness and many a times leading to visual disability and making them socio-economically unproductive and putting them into hardships in an already strained existence

The study evaluated the prevalence of ocular disease in HIV-infected patients on HAART, duration of HAART and duration of disease. Screening in this patient population is particularly important not only because of the high prevalence of ocular manifestations due to disease but also in view of the potential for worsening of ocular conditions due to HAART induced IRIS and other drug induced complications like anaemic retinopathy. We hereby conclude that HIV/AIDS has become a common disease in our population and affects the reproductive age group with male preponderance. HIV retinopathy was the most common ocular manifestation observed in our study With increasing duration of HAART incidence of ocular manifestations decreased. Anemic retinopathy was observed in patients who were on HAART for long duration and immune recovery uveitis was observed in early months of HAART

Recommendations

Further work is indicated to formally evaluate the validity of patient's symptoms in detecting different types of HIV associated ocular disease. The results of present study suggest that ophthalmic screening examinations might be prioritised for all HIV/ AIDS patients on and before HAART. Strategies for screening high-risk populations for HIV-related ocular disease are needed as well as provision for management and treatment of these conditions one detected.

Key Messages: With the advent of increased ART availability, life expectancy for HIV-infected persons is likely to improve. However, the burden of HIV-related ocular disease is likely to remain stable or even increase with possible immune reconstitution ocular complications. Strategies for screening high-risk populations for HIV-related ocular disease are needed.

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Conflict of Interest: NIL

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Original Article

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Early Detection of Glaucoma Prevents Visual Impairment : A Clinical Study

Nikhil RP[1], G Chandrasekhar[2], Vinod Potluri[3]

Abstract

Introduction: Of the irreversible causes of blindness, glaucoma ranks second which can be treated by early identification of disease and to slow its progression and preserve vision. *Aim:* The purpose of our study was to calculate the RNFL and ONH parameters using OCT in primary open angle glaucoma (POAG) patients and to determine if any correlation exists between the two. *Materials and methods:* The study included 95 eyes of 50 patients above 40 years of age with POAG. Central corneal thickness was calculated using optic pachymetry, IOP measurement using applanation tonometry. SD-OCT was used to calculate the RNFL and ONH parameters. *Results:* The ONH parameters and the RNFL thickness were tabulated and correlation between them was analysed. Superior and inferior quadrants thinning of RNFL was evident in most of the patients. Superior RNFL and the vertical ONH parameters showed best correlation (-0.442, p-value 0.005). *Conclusion:* The RNFL thickness were well correlated to optic disc parameters. OCT helps in acquiring high resolution accurate images, reproducible RNFL and retinal thickness measurement. OCT has shown to have greater diagnostic accuracy in RNFL measurements, there by helping the ophthalmologists to identify subtle changes of the normal RNFL pattern, ONH parameters before visual field defects develop.

Keywords: RNFL; ONH; POAG; SD-OCT

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Introduction

Visual morbidity have an adverse impact on physical and mental health [1]. Visual instability leads to accidents, emotional distress, social withdrawal, and depression when compared to healthy population [2]. Visual disturbances progresses as a person gets old and its progression depends on his systemic and ocular condition. Causes of visual impairment most commonly being cataract, glaucoma, age-related macular degeneration, and diabetic retinopathy are more prevalent among the elderly age group [3].

Glaucoma is identified by death of ganglion cells in spread over a period of years resulting in optic nerve damage leading to visual field loss and irreversible blindness [4]. Glaucoma is regarded as the second leading cause of irreversible blindness. 64.3 million people are affected with glaucoma between the age group 40-80 years, when study was done in 2013 and the prevalence increasing to 76.0 million in the year 2020 and 111.8 million in 2040 worldwide [4]. The estimated prevalence of glaucoma in India is 12 million around the age group of 40 years and older [5]. 6.48 million people are diagnosed withprimary open angle glaucoma (POAG) making it the most common variant [6]. Among 2.6% prevalence of glaucoma, POAG marks at 1.7%, PACG at 0.5% and 0.3% of secondary glaucoma after excluding pseudoexfoliation [7].

Author Affiliation: [1]Junior Resident, [2]Professor, [3]Junior Resident, Department of Ophthalmology, Narayana Medical College and Hospitals, Nellore, Andhra Pradesh 524003, India.

Corresponding Author: G Chandrasekhar, Professor, Department of Ophthalmology, Narayana Medical College and Hospitals, Nellore, Andhra Pradesh 524003, India.

E-mail: drgcseye@gmail.com

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Early Timed intervention can stop the progression of the disease and preserve. Retinal function can be measured with techniques such as SAP, SWAP and FDT [8]. However, more than 40% of the optic nerve axons can be damaged before glaucomatous changes are detectable by perimetry [9].

Optical coherence tomography (OCT), a well-accepted recent modality identifies early glaucomatous damage, Using glaucoma profile scan pattern measuring parameters like optic nerve head (ONH), retinal nerve fibre layer (RNFL) thickness and macular scan pattern. Highest resolution and faster scan rate are the peculiarities of spectral domain OCT (SD-OCT) which helps in acquiring ocular structures when compared with previous Time domain version of this technology [10]. It is based on Michelson Interferometry principle.

Assessment of posterior segment ocular structures is therefore a crucial step in early diagnosis of glaucoma along with progression analysis by using OCT.

Aims and Objectives

To study the optic nerve head (ONH) and retinal nerve fibre layer (RNFL) changes using optical coherence tomography (OCT) and to access the correlation between the parameters in primary open angle glaucoma patients (POAG).

Materials and Methods

A cross-sectional study, conducted in the department of ophthalmology at a tertiary care hospital, in South India

Institutional ethical committee approval was obtained for this study.

The study was conducted from January 2017 to June 2018. 95 eyes of 50 patients were included in the study.

A written informed consent was obtained from the patients.

Inclusion Criteria

- Patients above 40 yrs of age.
- Patients already diagnosed as glaucoma and on treatment
- Patients with the risk factors of glaucoma like
  (a) Raised intra ocular pressure
  (b) Family history of primary open angle glaucoma
  (c) Diabetes mellitus
  (d) Systemic hypertension

Exclusion Criteria

- High myopia
- Retinal pathologies
- Non-compliant patients
- Media opacity
- Uveitic glaucoma
- Secondary glaucoma

Brief Explanation of the Procedure

All cases of POAG who attended ophthalmology OPD were included.

- Detailed history regarding the ocular complaints, systemic diseases, family history and previous medical and surgical history was taken.
- A thorough ophthalmic examination was done which included

Recording of distant and near visual acuity by Snellen's chart and BCVA. Intra ocular pressure measurement by Goldman's Applanation Tonometry.

Anterior segment examination by slit lamp biomicroscopy.

Posterior pole examination by 78 D / 90 D lens for viewing the stereoscopic view of the optic disc and macula. Measurement of central corneal thickness was done by using DGH ultrasonic pachymetry.

ONH parameters and RNFL thickness measurements were obtained by SD-OCT. The patients were informed regarding the procedure that, it is an entirely non- invasive procedure and would need his utmost cooperation for a few minutes only. The pupils were dilated using tropicamide. The patient is seated comfortably in front of the OCT machine with chin positioned on chin rest. The patient is asked to fixate on the fixation target (green colour light). Serial scans were done. Signal strength of more than 6 was considered for analysis.

Visual field testing was done using Humphrey visual field.

All the above parameters were taken into consideration and were analysed.

Data Collection

All data was entered into a Data Collection Proforma Sheet (Annexure) and were entered into MS Excel 2013.

Statistical Methods

The study subjects were categorized according to age, gender in terms of percentages and standard deviation. The analysis of ONH and RNFL parameters was done. The correlation between the ONH and RNFL parameters was done using Pearsons correlation. The above statistical procedures were performed by the statistical package namely IBM SPSS statistics-20.

Results

Demographics

Out of 50 patients, 5 patients were one-eyed patients. The mean age of the patients was 61.58 ± 9.89 years. Among 50 patients there were 30 (60%) males and 20 (40%) females. The mean IOP was 24.18 ±3.504 mm Hg.

Among the patients, 26 were already on treatment and 24 were newly diagnosed cases. Figure 1 shows the risk factors among the patients. The mean CCT was 466 ± 2.1 microns. 33 patients had risk factors out of which 25 were diabetics, 5 had a family history of POAG and three patients were hypertensives.

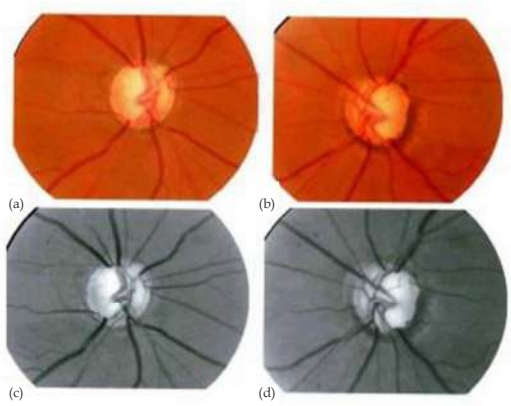

Fig. 1:

Optic Nerve Head Analysis

OCT was performed and parameters were evaluated. The mean disc area was 3.31 ± 1.161 mm^2; mean cup area was found to be 2.39 ± 1.09 mm^2. The mean rim area was 1.006 ± 0.872 mm^2. The mean CD area ratio was 0.708 ± 0.239. The mean cup depth was found to be 0.290 ± 0.134 mm and the max cup depth was 0.654 ± 0.206 mm. The mean C:D horizontal was 0.893 ± 0.152 and the mean C:D vertical was found to be 0.849 ± 0.142. (Table 1). (Figs 2- 5).

RNFL Analysis

RNFL thickness was measured by OCT in all four quadrants. RNFL thickness of all the patients were

Table 1: Analysis of ONH parameters

Parameter	Mean ± S.D	95% CI	
		Lower	Upper
DISC AREA (mm^2)	3.31 ± 1.161	3.08	3.55
CUP AREA (mm^2)	2.39 ± 1.09	2.17	2.62
RIM AREA (mm^2)	1.006 ± 0.877	0.83	1.18
C: D HORIZONTAL	0.893 ± 0.152	0.86	0.93
C: D VERTICAL	0.849 ± 0.142	0.82	0.88
C: D AREA RATIO	0.708 ± 0.239	0.66	0.76
MEAN CUP DEPTH (mm)	0.290 ± 0.134	0.26	0.32
MAX CUP DEPTH (mm)	0.654 ± 0.200	0.61	0.69

Table 2: RNFL Analysis

Parameter	Mean ± S.D (μm)	95% CI	
		Lower	Upper
SUP	105.28 ± 26.556	99.87	110.69
TEM	61.43 ± 13.789	58.62	64.24
INF	102.09 ± 25.593	96.88	107.31
NAS	75.28 ± 22.350	70.73	79.84

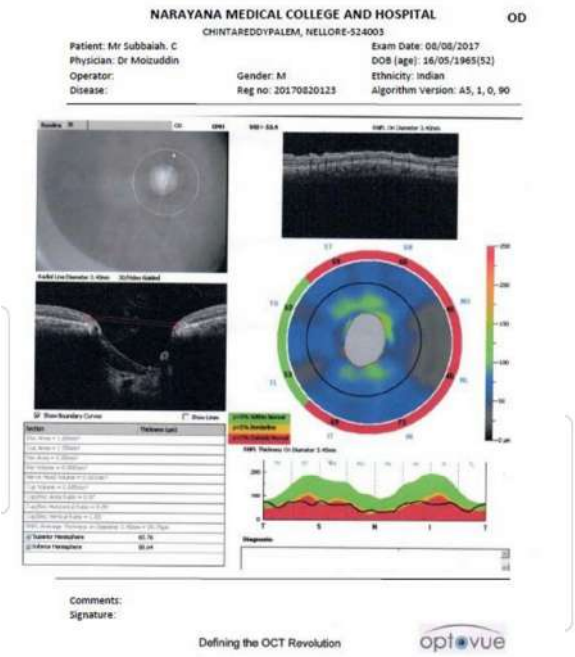

Fig. 2:

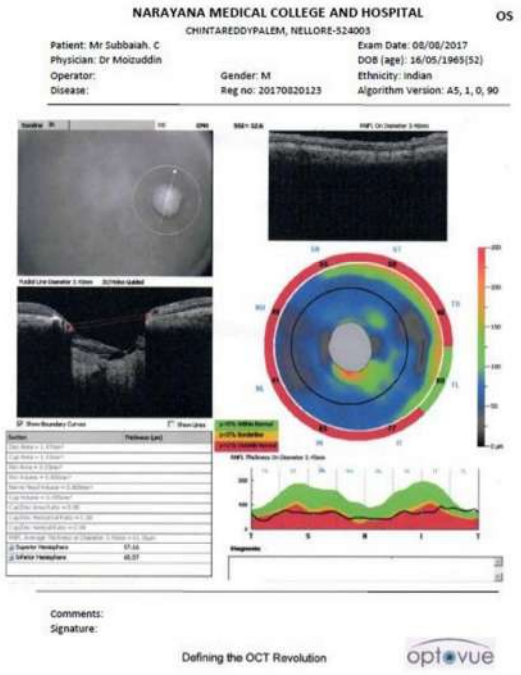

Fig. 3:

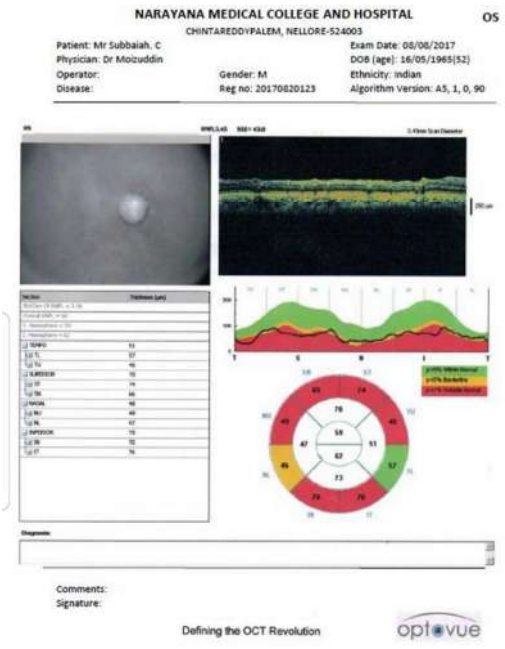

Fig. 4:

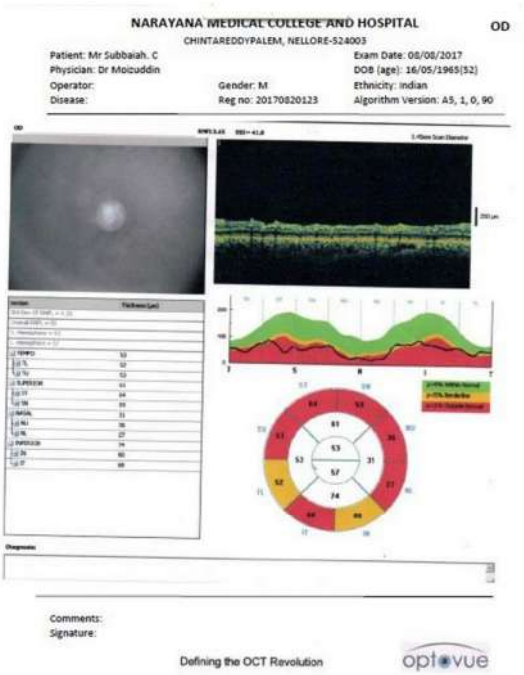

Fig. 5:

Table 3: Correlation between optic nerve head parameters and RNFL thickness

Disc Parameters	RNFL Thickness				
	Superior RNFL	Inferior RNFL	TemporalRNFL	Nasal RNFL	Average RNFL
DA (mm^2)	0.328**	0.387**	0.474**	0.341**	0.441**
CA (mm2)	0.044	0.060	0.296**	0.070	0.112
RA (mm^2)	0.404**	0.486**	0.151	0.436**	0.471**
C/D Ratio	-0.279**	-0.369**	-0.113	-0.295**	-0.336**
C:D Horizontal	-0.292**	-0.214*	-0.160	-0.366**	-0.317**
C:D Vertical	-0.442**	-0.416*	-0.76	-0.340**	-0.418**

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

analysed by each quadrant separately. Superior and Inferior thinning was found in most of the patients. Superior RNFL thickness was found to be 105.28 ± 26.55 µm. Inferior RNFL thickness was found to be 102.09 ± 25.593 µm. Temporal RNFL thickness was 61.43±13.789 µm and nasal RNFL thickness was found to be 75.28 ± 22.35 µm. Average RNFL thickness in POAG was 86.02 ± 22.07 µm. (Table 2)

Parameters and RNFLThickness

The disc area was moderately correlated with superior RNFL thickness (r = 0.328), inferior RNFL thickness (r = 0.387), nasal RNFL thickness (r = 0.341) and highly correlated with temporal RNFL thickness (r = 0.474), average RNFL thickness (r = 0.441). The cup area moderately correlates with temporal RNFL thickness (r = 0296). The rim area was moderately correlated with superior RNFL thickness (r = 0.404), nasal RNFL thickness (r = 0.436) and highly correlated with inferior RNFL thickness (r = 0.486), average RNFL thickness (r = 0.471). The CD ratio was moderately correlated with superior RNFL thickness (r = 0.279), nasal RNFL thickness (r = 0.295) and highly correlated with inferior RNFL thickness (r = 0.369), average RNFL thickness (r = 0.336) (Table 3).

Correlation between horizontal C:D, with nasal RNFL, temporal RNFL and vertical C:D with superior RNFL and inferior RNFL was done and found good correlation between vertical C:D with superior RNFL (Table 4,5)

Table 4: Correlation between the vertical C:D and the respective RNFL

RNFL	C:D-V
SUP	-0.442
INF	-0.416

Table 5: Correlation between the horizontal C:D with the respective RNFL

RNFL	C:D-H
NAS	-0.366
TEM	-0.160

Discussion

Glaucoma can impact on the performance of many daily activities like pedestrian walk, car driving, performing house hold activities, reading, assessment of distances and seeing objects coming from sideways there by affecting the productivity of life [11]. Since glaucoma is a disease found most commonly in elderly, it leads to increased risk of road traffic accidents and falls from height [12].

Long follow ups with ophthalmologists, ocular surface discomfort, one of the side effects of glaucoma medication contributes to overall burden [13]. Fear of becoming blind, emotional distress, financial constraints and other health issues make a person feel depressed leading to psychological burden [14]. Other weakening medical, psychological and social constraints may influence patients' visual morbidity. These complex interactions reduce the quality of life. Hence, early detection of glaucoma is very important in clinical management so that visual function and quality of life are preserved [15].

RNFL defects are the earliest detectable parameters in patients of glaucoma and may precede visual field changes by months or years. RNFL thinning is a sensitive indicator for detecting the extent of glaucomatous damage and that RNFL loss precedes measurable optic nerve head (ONH) and visual field (VF) damage approximately six years before any detectable VF defects [16]. Thus, the possibility of detecting these defects in areas

of physiological decreased visibility is enhanced, when Optical Coherence Tomography (OCT) is used. Optic disc and RNFL abnormalities, and their progression, require accurate and objective methods which would facilitate the diagnosis and monitoring of glaucomatous optic neuropathy [16].

In this study , there is direct correlation between the RNFL thickness and the ONH parameters similar to a few studies done previously by Savini G *et al*., Kasumovic S *et al*., [17,18]. There was a study done by Mansoori *et al*., which shows no correlation between the ONH and RNFL parameters [19].

Analysis of the pattern of RNFL defects with SD-OCT imaging have shown that most frequently RNFL defects have been at the infero-temporal meridian followed by the supero-temporal meridian [20] which is in correlation to this study.

RNFL progression analysis can also be performed using OCT. Glaucoma progression algorithms are of two types: event-based and trend-based approaches, similar to visual field progression detection methods. Event-based analysis compares both scans, the present and the previous and shows the difference between them. Trend-based approach using regression analysis data, defines the progression by monitoring the change over time to provide a rate of progression and corresponding significance level [21].

SD-OCT imaging technology is one of the most rapidly evolving and unparalleled new feature which is becoming possible with the help of 3D rendering. Sophisticated techniques and approaches for macular and optic disc evaluation are being investigated. It is most probable that SD-OCT will continue to integrate more accurate and feasible diagnostic strategies which are not currently available. Newer technologies such as swept source OCT, SD-OCT integrated with adaptive optics and polarisation-sensitive SD-OCT are currently under development. We however are hoping to gain a better understanding of the structural status of glaucoma through future use of state-of-the-art technologies [22].

Ongoing improvements in the hardware platforms and software algorithms will help in enhancing our understanding of the structural pathogenesis of glaucoma and offer more objective and accurate detection of structural damage and longitudinal change because of progression. A study done by Medeiros *et al*., demonstrated that algorithms that combine structural and functional measurements will improve the detection of glaucoma progression compared with either method used alone [23].

The limitations of this study being a cross sectional study and progression analysis could not be performed. Progression analysis provides an algorithm in the management that serves to be very helpful for patient education, leading to a good compliance.

Conclusion

Based on the results and the methodology employed, we have concluded that:

The RNFL thickness were well correlated to optic disc parameters.

OCT has been shown to obtain high resolution images and reproducible RNFL retinal thickness measurement.

OCT has shown to have greater diagnostic accuracy in RNFL measurements.

SD-OCT is a substantial objective and structural assessment instrument of recent times becoming a wonder technology that can help ophthalmologists in diagnosing and managing glaucomatous diseases (especially early stages), if used along with serial clinical scans.

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Original Article

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Evaluation of Endonasal DCR in the Management of Nasolacrimal Duct Obstruction

Hippergekar PM[1], Bhosale CB[2], Bhise SV[3]

Abstract

Dacryocystorhinostomy (DCR) is the standard surgical treatment for epiphora caused by obstructions distal to the common canaliculus. 102 patients of epiphora with obstruction in nasolacrimal duct secondary to chronic dacryocystitis were treated by endoscopic DCR. Concomitant surgeries were done in selected cases. All cases were diagnosed clinically by regurgitation test and sac syringing. Cases having epiphora due to other causes and due to pre-saccal obstruction were excluded. Average follow up was from 3 months to 1 year. Primary success rate 84.75% at the end of 6 months. Major complications was not found in any case. Adhesions and granulations around neo-ostium was the most common cause of failure. It was finally concluded that endoscopic DCR is safe and effective procedure for the management of epiphora secondary to nasolacrimal duct obstruction with comparable success rates and with no major complication.

Keywords: Epiphora, Chronic Dacryocystitis; Nasolacrimal Duct Obstruction (NLD); Endoscopic Dacryocystorhinostomy (End DCR).

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Introduction

Watering of eye is an extremely common ocular symptom. Watering may be due to obstruction to tear outflow (Epiphora) or due to increased tear secretion (lacrimation). Epiphora is due to compromise of lacrimal drainage [1].

Dacryocystorhinostomy (DCR) is the surgical treatment of choice for epiphora resulting from obstructions distal to the common canaliculus. DCR is a surgical procedure by which lacrimal flow is diverted into the nasal cavity through an artificial opening made at the level of the lacrimal sac [2]. Both endonasal and external approaches have been described to perform DCR. The traditional external approach DCR was first described by Toti (1904), [3] and modified by Dupuy-Dutemps & Bourguet (1920) with the suture of mucosal flaps [4]. The endonasal approach was described for the first time by Caldwell (1893), but it was forgotten for decades by the limited vision and the assessment of nasolacrimal anatomy. The introduction of microscope and later the endoscopic techniques, association with the close relation of lacrimal system and the nasal fossa, have made endonasal endoscopic surgical treatment of lacrimal affection very popular among otorhinolaryngologist. Currently, endoscopic DCR is a well established technique in the treatment of obstruction of the lacrimal sac and nasolacrimal duct [4].

The purpose of the present study is to present the experience in endoscopic DCR and to evaluate long term results of endoscopic DCR in the management of nasolacrimal duct obstruction.

Author Affiliation: [1]Professor [2]Consultant [3]Associate Professor, Department of E.N.T., Swami Ramanand Teerth Rural Medical College, Ambajogai, Beed, Maharashtra 431517, India.

Corresponding Author: Bhise SV, Associate Professor, Department of E.N.T., Swami Ramanand Teerth Rural Medical College, Ambajogai, Beed, Maharashtra 431517, India.

E-mail: bhisesudhir13@gmail.com

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Aims and Objectives

1. To study the age and sex incidence associated with chronic dacryocystitis.
2. To evaluate long-term results of endoscopic DCR in the management of epiphora due to nasolacrimal duct obstruction.
3. To study complications (intra-operative & post-operative) associated with endoscopic DCR.
4. To study the causes of failure of endoscopic DCR.

Materials and Methods

Present study comprises of 102 patients having epiphora due to nasolacrimal duct obstruction diagnosed as chronic dacryocystitis presenting between January 2015 to January 2017.

The patient presenting with epiphora were examined and investigated thoroughly. Chronic dacryocystitis was diagnosed on the basis of clinical examination by doing regurgitation test and lacrimal sac syringing. Thorough endoscopic examination of nose done was done in all patients. Patients with lower lid laxity, suspicious malignancy, orbital bone deformity and dacryocystectomy on the same side were excluded from our study.

An informed written consent was obtained from all the patients undergoing endoscopic DCR. Most of the cases were operated under local anaesthesia with sedation.

Surgical Technique

Nasal pack with 4% lignocaine with 1:1,00,000 adrenaline was applied 15 minutes before surgery to decongest nasal mucosa. 0 degree rigid endoscope, 4 mm in diameter was used. The site of operation, in the area of anterior attachment of the middle turbinate is injected with 2% lignocaine with 1:1,00,000 adrenaline solution. Incision with the help of No.12 knife was taken starting just superior to the axilla of middle meatus, continued down vertically till about 2/3rd the length of the middle turbinate on the lateral nasal wall, then curved horizontally for about 8 mm and then joined to the posterior limit of uncinate process. The mucosa was elevated with a Freer's elevator to expose the underlying frontal process of maxilla beneath which lacrimal sac lies. The thick bone of the frontal process of maxilla was removed with a Kerrison's DCR punch. Sometimes an osteotome was required to expose the sac. The position and exposure of the lacrimal sac was confirmed by probing with a metal probe. The lacrimal sac was then incised with the help of sickle knife or 2.8 No. keratome, lacrimal mucosa was removed and ablated, and opening was enlarged sufficiently. After confirming the common canaliculus, sac syringing was done to confirm the free flow of fluid through the osteum. Nasal packing was done with liquid paraffin or soframycin ointment for 24 hours.

Post-operative Care and Follow-up

Nasal pack was removed after 24 hours post-operatively. Nasal suction and sac syringing under endoscopic control was done on the day of discharge i.e. on day 3. Patients were followed-up regularly on day 7, 1 month, 3 month, 6 month and 1 year.

At every post-operative visit sac syringing was done to check the patency of the stoma. Nasal endoscopy was also done to confirm patency and condition of stoma and to remove crusts if present.

Success Criteria

In present study the success of endoscopic DCR was assessed on the basis of symptomatic relief and sac syringing under endoscopic control. The condition of stoma was also assessed for anatomic success. In present study complete absence from symptoms, free flow on sac syringing and demonstration of patent stoma on endoscopy was considered as success. The patients who had partial relief were considered unsuccessful.

Results

In present study following observations was made. Most of the patients were between 30–39 years of age group N=30 (29.42%), followed by 60–69 years of age group N=25 (24.52%). The mean age was 44.42 years. ± S.D.

We found that epiphora was significantly ($Z=2.13$, $p<0.05$) more commonly seen in females N=61 (59.80%) than males N=41 (40.20%). The ratio of female to male was 1.49:1.

In this study majority of the cases were farmers N=39 (38.24%) and labourers N=28 (27.45%) which were from low socio-economic status and rural background.

Most of the cases had unilateral involvement N=90 (88.24%). Bilateral involvement was found

in 12 cases. Out of 90 cases of unilateral epiphora right side was involved in 52.22% (N=43) and left side was involved in 47.78% (N=43) cases, but the difference was not statistically ($Z=0.63$, $p > 0.05$) significant.

We had found epiphora being present in all patients (100%). The other common presenting symptoms were discharge from eye N=47 (46.08%), diminution of vision N=38 (37.25%), sticky eye N = 21 (20.58%) and medial canthal swelling N = 13 (12.75%) in descending order.

We had found, deviated nasal septum (DNS) N=46 (45.10%) was the most common associated nasal pathology. Of which in 24 cases, DNS was present on the same side of epiphora. Chi-square test revealed that there was no statistically significant association between side of DNS with side of epiphora. ($\chi^2 = 2.577$, d.f. =2, $p > 0.05$). The other nasal pathologies found were hypertrophic turbinates N=22 (21.57%), concha bullosa N=5 (4.90%), Agger nasi cells N=3 (2.94%), atrophic rhinitis N=2 (1.96%) and one case of nasal polyposis.

We had done majority of endoscopic DCR under local anaesthesia with sedation N=99 (97.06%) successfully. Only 3 patients which were children carried under general anaesthesia.

Out of 102 patients, 96 cases (94.12%) were primary as compared to 6 revision cases (5.88%). Revision cases included previously operated endoscopic DCR (N=5) and one case of external DCR.

Five out of 46 cases (4.90%) had DNS underwent concomittent septoplasty. Other procedures done were clearance of agger nasi cells in 3 cases (2.94%) and conchoplasty in 2 cases for enlarged concha bullosa (1.96%).

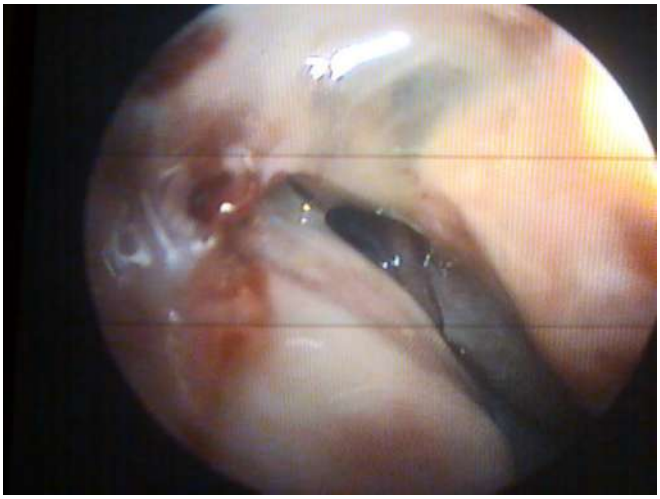

Fig. 1: Picture showing postoperative follow up at 6 months

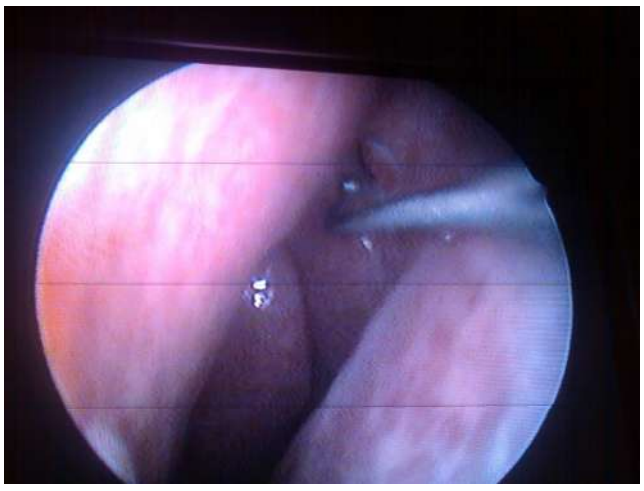

Fig. 2: Picture showing wide stoma postoperative 6 months

Most common complication observed were synechiae/ adhesions in 6 cases (5.88%). Out of that two cases had synechiae between nasal septum and lateral nasal wall which were treated under local anaesthesia successfully. Four cases had adhesions around neoostium efforts to treat them were failed and these patients went on to have partial blockage of stoma. Second most common complication we observed was periorbital oedema N=4 (3.92%), which was treated with antibiotics and anti-inflammatory drugs. Two patients (1.96%) had granulations around neoostium causing initial partial obstruction which later became complete obstruction. There were no major complication such as CSF rhinorrhoea, wound infection or post operative bleeding.

In present study, patients were followed up regularly on day 3, day 7, day 30, 3 months, 6 months and 1year post-operatively .In our study, 74.74% patients were available for follow up at the end of 3 months, 67.82% patients were available for follow up at the end of 6 months and 15.07% of follow up at one year. The patients in present study were largely from low socio economic status. They were also from rural background. Follow up visit for them entails loss of daily wages and also expenses in traveling. So obviously patients who were not having symptoms post-operatively are likely to skip follow up visits. However to avoid bias by considering them to be successful we had analyzed results for the patients who were actually available for follow up at the end of 6 months (Figs. 1, 2).

Assessment of results in present study revealed that 84.75% of patients (51 out of 59 cases available for follow up) had complete success at the end of 6 months.

In present study of 102 patients, 59 were available at the end of 6 months. 9 cases (15.25%) had failure. Partial relief in symptoms was also classified as failure. Evaluation of these 9 cases of failure revealed that adhesions (N=4) and granulations (N=2) around stoma was the commonest cause of failure.

Discussion

Nasolacrimal duct obstruction causes hindrance to the normal outflow of tears from eye to nose causing epiphora. In present study maximum patients were between 30–39 years (29.42%) of age group followed by 60–69 years (24.51%) of age group. Youngest patient was 11 year old and eldest patient was 72 year old. The mean age of patients was 44.42 years ±S.D. The age distribution and mean age in our study correlate well with other studies of Sarda (1961) [5], R. Dalgleish (1967) [6], Vishwakarma (2004) [7].

In present study we found that epiphora secondary to nasolacrimal duct obstruction was more commonly seen in females 59.80% (61 cases) than males 40.20% (41 cases).The ratio of Female to Male was 1.49:1. Our data correlate well with studies of R. Dalgleish (1967) [6], Kashkouli (2003) [8]. Many explanations for higher incidence of epiphora in females have been put forward. Meller (1929), Ruiz Barraco and Martinez Roman (1966) [9] and Mangal sing (2004) [10] stated that this difference was due to a narrower bony nasolacrimal canals in females. Heinonen (1920) blamed the high incidence amongst females to the fact that females had a higher nasal index [9]. Duke Elder attributed the higher incidence among females to hormonal changes that brings about generalized de-epithelisation in the body. Similar de epithelization may occur within the lacrimal sac and duct. An already narrow lacrimal fossa in women predisposes them to obstruction by the sloughed out debris [9]. Duggal *et al*. (2006) blamed the inferior social status accorded to females in our country, which leads to poor hygiene amongst them, for higher incidence of dacryocystitis in females [11].

In present study most of the patients had unilateral epiphora 90 cases (88.24%). Out of 90 cases of unilateral epiphora, 47 cases (46.08%) had right sided epiphora and 43 cases (42.16%) had left sided epiphora. The difference was statistically insignificant meaning that there is no predilection for a particular side in patients with epiphora. The findings correlate well with those reported in literature. Dalgleish (1967) [6], N N Sood *et al*. (1967) [12], Muhammad Nawaz *et al*. (2008) [13], Rupender K. Ranga *et al*. (2008) [14]. In present study 12 cases (11.76%) had bilateral epiphora. In general it can be stated that epiphora has no predilection to any side and incidence of bilaterality increases with age.

In present study, most common nasal pathology encountered on preoperative nasal endoscopy was deviated nasal septum in 46 cases (45.10%) of which 24 cases were on the same side of epiphora. The other nasal pathologies found were hypertrophic turbinates 22 cases (21.57%), concha bullosa 5 cases (4.90%), Agger nasi cells 3 cases (2.94%), atrophic rhinitis 2 cases (1.96%), and one case of nasal polyposis.

Mandal R *et al*. (2008) states that some form

of nasal pathology like hypertrophic inferior turbinate, deviated nasal septum, nasal polyp and allergic rhinitis were found in 19.6% of the patients of epiphora secondary to chronic dacryocystitis [15].

Mechanical obstruction, particularly as result of an enlargement or flattening of the inferior turbinate is frequently associated with epiphora. This obstruction may obliterate the anterior part of the meatus and may cause a local rhinitis implicating the opening of the nasolacrimal duct [9]. Similarly a deviation of the septum may compress the inferior turbinate against the lateral nasal wall [9]. Enlarged agger nasi cells can cause direct compression at the junction of nasolacrimal duct and lacrimal sac or in the lower part of lacrimal sac [10]. Atrophic conditions in the nose frequently figure in the aetiology of dacryocystitis. The destruction of the mucosa leaves a patulous ostium which not only permits ready extension of the disease upwards but also allows the direct entrance of infective secretion into the duct on blowing the nose leading to inflammation and subsequent obstruction [9].

In present study, out of 46 cases of deviated nasal septum, incidence of deviated nasal septum on the same side of affected eye was 24 (23.53%). However the concomitant septoplasty was needed in 5 cases (4.90%). Other concomitant procedures done were clearance of agger nasi cell in three cases (2.94%), two cases had undergone conchoplasty for enlarged concha bullosa of middle turbinate (1.96%). Routine septal surgery is not indicated during endonasal dacryocystorhinostomy. It is the best reserved for the cases in which there is difficulty in accessing the area of the sac because of septal deviation. If the middle turbinate is not visible with the endoscope preoperatively owing to a septal deviation or spur then access is tight and dacryocystorhinostomy with septoplasty is needed. Enlarged agger nasi cells can cause direct compression at the junction of nasolacrimal duct and lacrimal sac or in the lower part of lacrimal sac [10]. An enlarged concha bullosa cramps the access intra-operatively. There is always a chance of mucosal injury on lateral aspect of concha leading to synechiae and lateralization of turbinate.

In present study, Endonasal endoscopic dacryocystorhinostomy was largely carried out under local anaesthesia with sedation successfully. Only three cases which were children, carried out under general anaesthesia. An effective and acceptable local anaesthetic technique enables the avoidance of the risks associated with general anaesthesia, particularly for elderly patients, with the added benefit of reduced bleeding, reduced nausea and vomiting and reduced length of hospital stay and thus health care cost savings.

In present study, 96 patients were underwent primary endonasal dacryocystorhinostomy and 6 patients were revision cases. Out of 6 revision cases 5 had undergone dacryocystorhinostomy earlier while one case had undergone external dacryocystorhinostomy. Surgery for revision of endoscopic dacryocystorhinostomy proceeded exactly as for primary cases. In fact case of revision surgery is an advantage of endoscopic surgery as bone is already partially removed. The reason why endoscopic dacryocystorhinostomy fails is in understanding the anatomy of lacrimal sac. Earlier teaching suggested that the sac lies anterior and inferior to middle turbinate. So just exposing sac and taking an incision is bound to result in failure. It is important to note that much of sac lies above the axilla of middle turbinate. Removal of the bone in this region to identify sac and removal of medial wall of the sac in this region completes the surgery [16].

In present study most common post-operative complication was synechiae/adhesions in 6 cases (5.88%). Out of these 6 cases 2 cases had synechiae /adhesions between septum and lateral wall which neither affecting the stomal patency nor causing nasal obstruction in the post operative follow up period. These adhesions were released under local anaesthesia. 4 cases had adhesions around the stoma causing partial blockage. We had operated most of the patients having deviated nasal septum without doing concomitant septoplasty. In such cases there might be chances of mucosal trauma during the procedure while working in the sac region which may be the reason for formation of synechiae/adhesions later on. Our findings correlate well with other studies like Minasian M *et al.* (1999) [17], Mangal Sing *et al.* (2004) [10]. In present study second most common complication was periorbital edema in 4 cases (3.92%) which was treated with antibiotics and anti inflammatory drugs. Exact cause of this periorbital edema was not known. However the fragility of vessels in the venous plexus around the sac in old age may lead to extravasation of blood leading to periorbital edema. In present study 2 patients had granulations around stoma causing initially partial obstruction which later on became complete obstruction. Bone left exposed at the end of surgery is known to cause granulations around the stoma in endoscopic procedures. Inadvertently exposed bone and infection may be the cause of granulation

formation. These patients went on to become failure despite of the treatment. P J Wormald (2002) stated that if the surgical ostium is small with areas of exposed bone, granulation tissue forms leading to post operative stenosis and high risk of failure [18]. Minasian M *et al.* (1999) observed granulations adjacent to the ostia in 2 cases (12.5%) [17]. Kansua *et al.* (2009) encountered granulation tissue at the rhinostomy opening in 7 patients, out of that in 4 cases granulations obstructed the neo-ostium in his 78 endoscopic endonasal dacryocystorhinostomy.

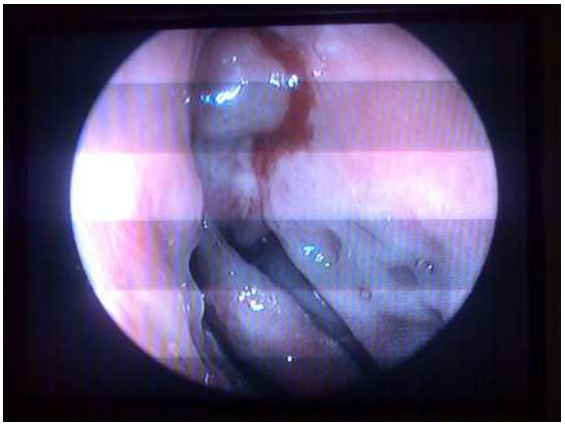

Fig. 3: Picture showing postoperative complication- granulations at stoma site

It is important to note that gradual narrowing of the rhinostoma site occurs to some extent during mucosal healing. The majority of surgical failures occurs between 2 and 6 months [19]. It is established fact that healing is complete in most of the cases between 3rd to 6th week of operation. After that there is minimal change in the size of rhinostome and it becomes stable after 6 months of operation [10]. According to guidelines published by Royal collage of Ophthalmologists, lack of epiphora 3 months after surgery is good indicator of successful surgery [20]. So in present study we have adequate follow up period with available follow up cases at the end of 3 and 6 months to calculate success rate.

Many studies have used patient's symptoms as an assessment of outcome. Some studies report additional objective measurements of success such as sac irrigation or by nasal endoscopic examination. Therefore in present study the success of endoscopic dacryocystorhinostomy was assessed on the basis of symptomatic relief, sac syringing and endoscopic demonstration of patent stoma. In present study complete absence from symptoms along with free flow on sac syringing with demonstration of stoma was considered as success. The patients who had partial relief were considered unsuccessful. Assessment of results in present study revealed that 84.75% of patients (51 out of 59 cases available for follow up) had complete success at the end of 6 months.

The results in present study compare well with other studies.

In present study, 9 out of 59 patients available for follow up at the end of 6months had failure of surgery. Evaluation of these patients for identifying the cause of failure revealed that 4 cases (3.92%) had adhesions around the stoma causing partial obstruction and two cases (1.96%) had granulations around the stoma causing complete obstruction. It has been frequently reported in literature like Minasian *et al*. (1999) [17], Ben Simon *et al.* (2005) [26], Sung Wook Yoon *et al.* (2006) [27], Sharma B R *et al.* (2008) [28], that nasal mucosal synechiae and granulations are associated with higher frequency of failure cases. In present study out of these 9 failure cases, 1 case (0.98%) revealed closure of neo-ostium endoscopically. Cokkeser *et al.* (1999) in his study of 56 cases of endoscopic dacryocystorhinostomy observed gradual closure of the rhinostoma site in 8 eyes between 1 and 2 months [19]. In one case the sac wall thickened and there were adhesion inside the sac also. Though sac syringing was successful on table in follow up period patient had residual symptoms and partial patency of sac. In one case we could not identify sac endoscopically. The patient had

Table 1:

Sr. No	Name of Author	Year of study	Number of cases	Follow up	Success rate
1	Sprekelson *et al.* [21]	1996	152	12 months	85.5%
2	Hartikainen *et al.* [22]	1998	64	12 months	75%
3	Minasian *et al.* [17]	1999	16	6 months	81%
4	Yung and Hardman-Lea *et al.* [23]	2002	96	6 months	89%
5	Durvasula *et al.* [24]	2004	70	29 months	83%
6	S.K. Singhal *et al.* [25]	2005	37	9 months	89.7%
7	Present study	2009	102	6 months	84.75%

earlier undergone external dacryocystorhinostomy. The details of the procedure were not known. The adhesions and fibrosis in the sac region may be the reason for failure in identifying the sac. Probably more preoperative investigation like dacryocystography and use of illuminator during surgery may help in such cases.

Conclusion

Finally from the results of present study, we conclude that,

1. Epiphora secondary to nasolacrimal duct obstruction is more common in middle aged and elderly females.
2. Endoscopic DCR is safe and effective procedure for the management of epiphora secondary to nasolacrimal duct obstruction.
3. Local anaesthesia with sedation is sufficient for carrying out operative procedure successfully.
4. Septal deviation is not always hindrance to procedure, very few patients required septal correction for improving the access.
5. Endoscopic DCR is not associated with any major complication.
6. Adhesions and granulations around stoma are most common cause of the failure.

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A Study of Adverse Clinical Consequences of Neodymium Doped Yttrium Aluminum Garnet (Nd : YAG) Laser Treatment for Posterior Capsular Opacification : A Rural Hospital Based Approach

Preeti A Rawandale Patil[1], Surendra P Wadgaonkar[2], Sanjay V Vaghmare[3], Sonam R Rathod[4]

Abstract

Introduction: Posterior capsular opacification (PCO) is the most common delayed complication after ECCE surgery with or without PC-IOL. Neodymium Doped Yttrium Aluminum Garnet (Nd : YAG) laser for posterior capsulotomy is widely used and it has been gradually replacing surgical capsulotomy because it is safe, non-invasive and effective procedure with minimal complications of vitreous loss and endophthalmitis as compared to surgical capsulotomy. Complications of Nd : YAG laser posterior capsulotomy are raised intraocular pressure (IOP), corneal damage, iritis, intraocular lens (IOL) pitting or dislocation, cystoid macular edema (CME), disruption of the anterior vitreous face, retinal detachment (RD), endophthalmitis and vitreous hemorrhage. The purpose of the present study is to to evaluate the complication rate following Nd : YAG laser capsulotomy. *Aims and Objectives:* To assess the complication following Nd : YAG laser capsulotomy. *Material and Methods:* The study has been performed in our institute between September 2013 to September 2015. 100 eyes of 100 patients with PCO were considered for Nd : YAG laser capsulotomy after minimum period of 6 months following uncomplicated extracapsular cataract extraction. Following the capsulotomy, all patients were routinely given topical antibiotics-steroid combination and topical anti-glaucoma drops. Patients were reviewed after 1 hr for assessment for tonometry, slit lamp biomicroscopy. Anterior chamber reaction were looked. IOP assessment was done after 1hr, 1week, 1month and 6month. Rise in IOP was noted. If IOP was raised for hours and retured to normal at the end of 7 days, it labelled as transient IOP rise. Persistent IOP rise was labeled if sustained high IOP on follow up visits. Patients were also looked for visual acuity, any incidence of iritis, retinal detachment, cystoid macular edema. *Results:* In our study, most frequent complication was rise in IOP. The immediate IOP rise (IOP one hour after Nd : YAG laser capsulotomy) was recorded in 31% of patients. Mean summated laser energy in a group of patients with immediate IOP rise (62.39) was significantly high as compared to group of patients with normal IOP. In our study, pitting of IOL was seen in 6% of patients. Mean summated laser energy level in patients with pitting of IOL was 80.67 mJ as compared to 52.36 mJ in patients without IOL pitting. The mean summated laser energy was significantly higher ($p=0.002$) in a group of patients with IOL itting. In our study, iritis was noted in 7% of patients. The mean summated laser energy was significantly higher ($p<0.001$) in a group of patients with iritis. The mean summated laser energy level in patients with iritis was 85.14J as compared to 51.72 mJ in patients without iritis. In our study, CME was seen in 3% of patients. Mean summated laser energy in patients with CME was 74.67 mJ versus 53.42 mJ in patients without CME (97%). Mean summated laser energy was not significantly higher in patients with CME ($p=0.098$). In our study, anterior hyaloid face rupture was noted in 9% of patients, but none of the patient had vitreous in anterior chamber. Mean summated laser energy level in patients with anterior hyaloid face rupture was 75.11 mJ which was significantly higher ($p=0.002$) as compared to 51.98 mJ in patients without rupture of anterior hyaloid face (n=91). *Conclusion:* Complications with Nd : YAG laser capsulotomy are minimal and transient. Complications such as raised intraocular pressure, pitting of IOL, iritis, anterior hyaloid face rupture more common if mean summated energy level was high. The total laser energy delivered were not risk factor for the development of cystoid macular edema. Healthy pseudophakia eyes generally do not have retinal detachment after Nd : YAG laser capsulotomy. To minimize the complications, lowest possible laser energy level should be used for Nd : YAG laser capsulotomy.

Keywords: Posterior Capsular Opacification (PCO); Nd:YAG Laser; Capsulotomy

Author Affiliation: [1,3]Associate Professor [2]Professor & Head, Department of Ophthalmology, ACPM Medical College, Dhule, Maharashtra 424002, India. [4]Senior Resident, Department of Ophthalmology, ESIC Hospital, Andheri, Mumbai, Maharashtra 400093, India.

Corresponding Author: Surendra P Wadgaonkar, Professor & Head, Department of Ophthalmology, ACPM Medical College, Dhule, Maharashtra 424002, India.

E-mail: surendrawadgaonkar@gmail.com

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Introduction

Posterior capsular opacification (PCO) is the most common delayed complication after ECCE surgery with or without PC-IOL. Visually significant PCO is defined as post-operative best corrected visual acuity decreased by two snellen's lines.1 Patients who have PCO with significantly reduced visual acuity need posterior capsulotomy that is, opening up of the posterior capsule so as to improve vision. Posterior capsulotomy can be done by two ways: Neodymium doped yttrium aluminum garnet (Nd : YAG) laser capsulotomy and Surgical capsulotomy.

Nd : YAG laser for posterior capsulotomy is widely used and it has been gradually replacing surgical capsulotomy because it is safe, non-invasive and effective procedure with minimal complications of vitreous loss and endophthalmitis as compared to surgical capsulotomy [2].

In Nd : YAG laser capsulotomy, a small opening is created in the center of the opacified posterior capsule by a Nd : YAG laser pulse with energy of few millijoules (mJ) for a duration of few nanoseconds. Various factors such as IOL fixation, subtype of PCO can affect the energy level used for capsulotomy. Some studies recommend lower starting energy level for capsulotomy to minimize the incidence of complications of Nd : YAG laser capsulotomy [3].

Complications of Nd : YAG laser posterior capsulotomy are raised intraocular pressure (IOP), corneal damage, iritis, intraocular lens (IOL) pitting or dislocation, cystoid macular edema (CME), disruption of the anterior vitreous face, retinal detachment (RD), endophthalmitis and vitreous hemorrhage [4,5,6].

The purpose of the present study is to to evaluate the complication rate following Nd : YAG laser capsulotomy.

Aims and Objectives

To assess the complication following Nd : YAG laser capsulotomy.

Material and Methods

The study has been performed in our institute between September 2013 to September 2015. 100 eyes of 100 patients with PCO were considered for Nd : YAG laser capsulotomy after minimum period of 6 months following uncomplicated extracapsular cataract extraction. Before Nd:YAG laser capsulotomy, all patients were analysed in following manner:

History

Demographic information like name, age, sex, occupation, address was obtained from each patient.

Visual Acuity

Visual acuity of all patients were recorded using snellen's chart or illiterate E chart of both eye.

Slit Lamp Examination

Slit lamp examination was done for examination of the anterior segment. The extent and intensity of the subtypes of PCO (membranous i.e. pearl, fibrous and fibro-membranous) was evaluated by slit-lamp grading as it is commonly performed method in clinical practice. Many slit lamp grading systems exits but none have been proven to be gold standard [7]. We used the slit lamp grading criteria described by Kruger *et al*. [8] in 2000. Kruger *et al*. used grading system 0 to 3 for evaluation of PCO. Grade 0=absent, Grade 1=very mild, Grade 2=moderate, Grade 3=dense white. The capsule behind the optic was evaluated within a central area of 3 mm diameter and also evaluated in the periphery. Distinction was given to the grading of elschnig pearls and fibrosis [8].

Grading criteria was important in deciding the initial energy level for subtypes of PCO which was necessary for Nd:YAG laser capsulotomy.

Tonometry: Intraocular Pressure was measured by using goldmann applanation tonometer. Normal range of IOP was considered to have range of 10–21 mm of mercury (mmHg).

Fundus Examination

Fundus was examined using direct or indirect ophthalmoscope to rule out the cause of reduced vision other than PCO. Ultrasound B-scan was done in patients with dense PCO.

Inclusion Criteria

1. Patients operated by Extracapsular cataract extraction with Posterior chamber intraocular lens implantation
2. Patients with significant PCO.
3. Age between 40 to 80years.

Exclusion Criteria

1. Patients operated by Extra Capsular Cataract Extraction without Posterior chamber intraocular lens implantation.
2. Past history of any ocular surgery other than cataract.
3. Any clinical evidence suggestive of glaucoma.
4. Any other anterior or posterior segment pathology.
5. Eyes with any ocular adnexal disorder.
6. History of diabetes, pemphigus, collagen vascular diseases, stevens johnson's syndrome or immunocompromised patient.

Preparation of the Patient

After complete evaluation, patient was taken for laser capsulotomy. The procedure was explained to the patient. Patient is informed that procedure is painless, with each shot he or she may hear small clicks. The informed consent is taken. Pupil were dilated with 1% tropicamide and 2.5% phenylephrine.

Anaesthesia

Topical anaesthesia with one drop of 4% xylocaine. Positioning: Nd : YAG laser capsulotomy was performed with the patient in a seated position. Adjustment of stool, chin rest and foot rest was done for patient's comfort. Head strap was applied. Darken the room optimally.

Equipment

An abraham Nd : YAG capsulotomy lens is used in conjunction with a coupling agent, such as 2% hydroxypropyl methylcellulose, to form a seal on the eye. Lens helps to keep the eye open, the lens has a 10.0–mm helium-neon YAG-coated plano-convex 1.8 × magnification button positioned at the center of the lens, which focuses the beam spot size on the posterior capsule.

Capsulotomy technique

Posterior capsule was focused with helium-neon (He-Ne) beam. The intersection of the helium-neon beam where the two red spots becomes one that spot was used and it is the focal point of laser energy. Tension lines were identified and cut across tension lines. The usual strategy is to create cruciate openings at $12^{O'}$clock periphery. Progress downwards towards $6^{O'}$clock position. Cut across $3^{O'}$clock and $9^{O'}$clock position. Any tag which remain in pupillary space, laser fired at the flap to cut them and cause them to retracted fall back periphery. Free floating tags were avoided. In this way, capsulotomy of 3 mm size was done with single pulse Q-switched Nd : YAG laser (Visulas YAG II plus, Carl Zeiss, Germany). The energy and pulses were increased gradually according to the thickness of capsule until an opening was achieved.

The starting initial energy level, number of pulses used to create capsulotomy and mean laser energy level was noted in each case.

Post Laser follow-up

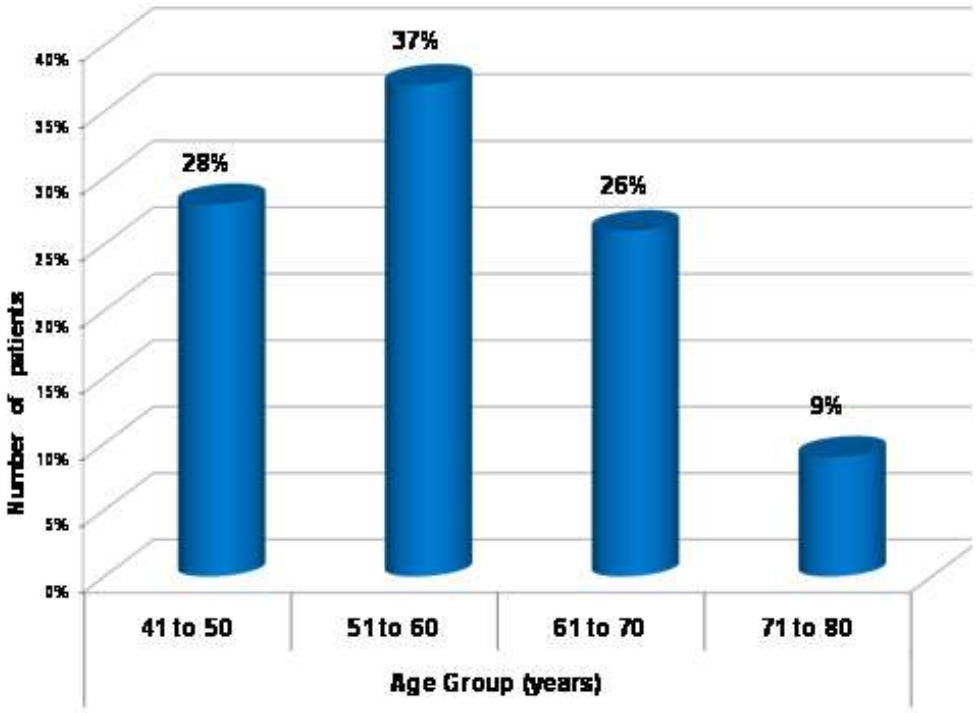
Following the capsulotomy, all patients were routinely given topical antibiotics-steroid combination and topical anti-glaucoma drops. Patients were reviewed after 1 hr for assessment for tonometry, slit lamp biomicroscopy. Anterior chamber reaction were looked. IOP assessment was done after 1hr, 1week, 1month and 6month. Rise in IOP was noted. If IOP was raised for hours and retured to normal at the end of 7 days, it labelled as transient IOP rise. Persistent IOP rise was labeled if sustained high IOP on follow up visits. Patients were also looked for visual acuity, any incidence of iritis, retinal detachment, cystoid macular edema.

Results

Age distribution

Table 1: Age group wise distribution of patients undergoing Nd : YAG laser capsulotomy.

Age Group	Frequency	Percent
41 – 50	28	28.0
51 – 60	37	37.0
61 – 70	26	26.0
71 – 80	9	9.0
Total	100	100.0



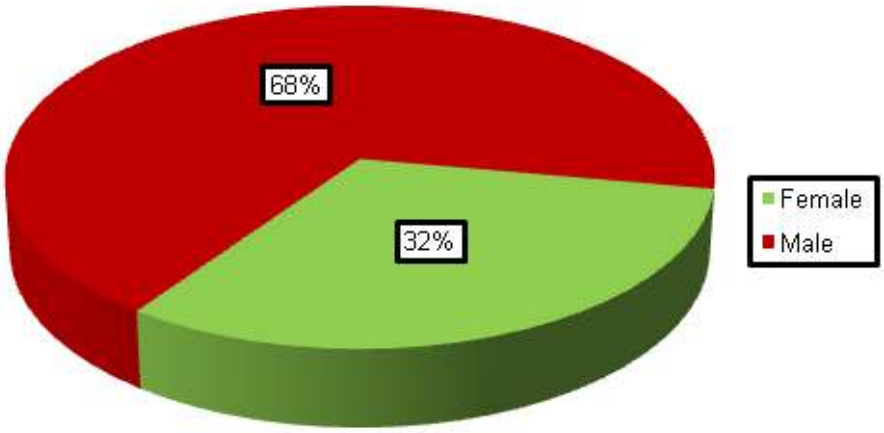
Graph 1: Age group wise distribution of patients undergoing Nd : YAG laser capsulotomy.

Table 1 & Graph 1: Shows that out of 100 patients with PCO, maximum number of patients (37%) were of 51 to 60 years of age group. Mean age in the study was 58 years with 9.07 SD and ranging within 42 to 79 years

Sex Distribution

Table 2: Sex wise distribution of patients undergoing Nd:YAG laser capsulotomy.

Sex	Frequency	Percent
Female	32	32.0
Male	68	68.0
Total	100	100.0

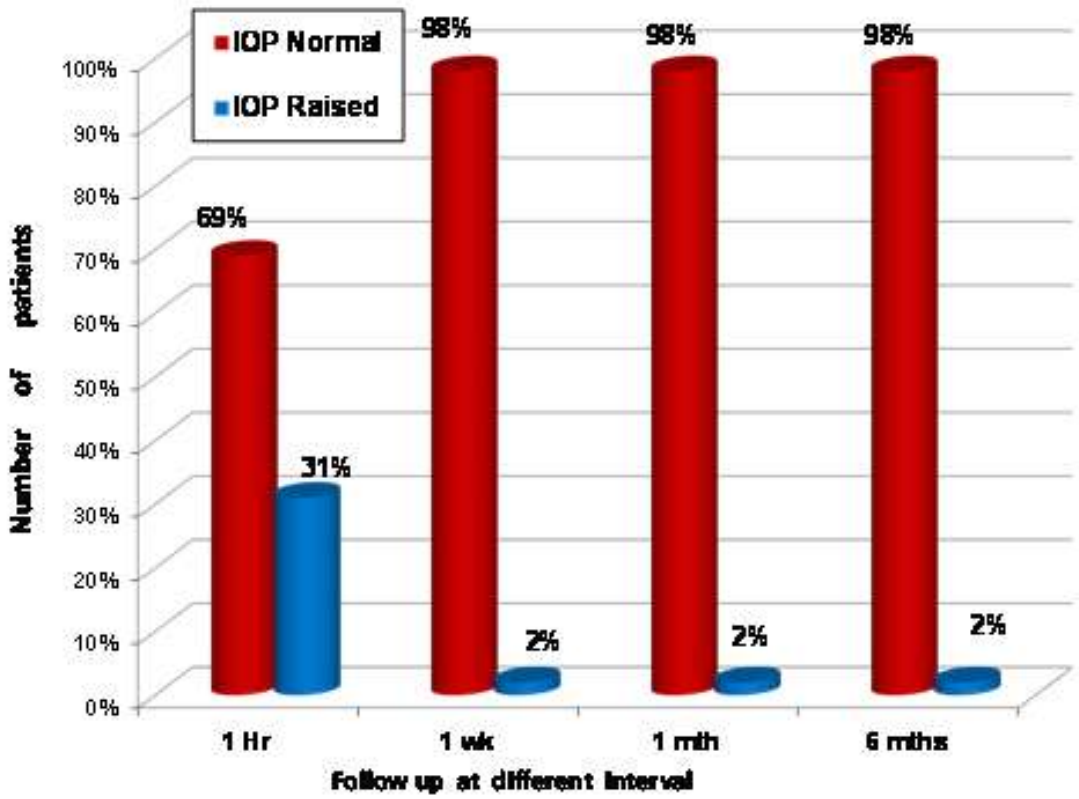


Graph 2: Sex wise distribution of patients undergoing Nd:YAG laser capsulotomy.

Table 2 & Graph 2: Shows that 68% were male and 32% were female in present study.

Table 3: Changes in IOP at different interval after Nd:YAG laser capsulotomy

IOP	1 hour		1 wk		1 month		6 month	
	N	%	N	%	N	%	N	%
Normal	69	69.0%	98	98.0%	98	98.0%	98	98.0%
Raised	31	31.0%	2	2.0%	2	2.0%	2	2.0%
Total	100	100.0	100	100.0	100	100.0	100	100.0

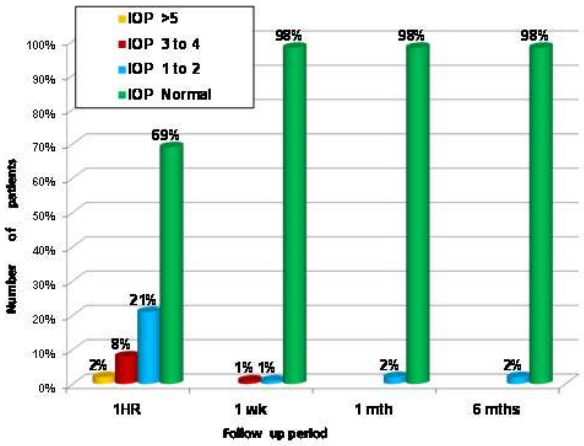


Graph 3: Changes in IOP at different interval after Nd : YAG laser capsulotomy

Table 3 & Graph 3: Shows that 1 hour after Nd:YAG laser capsulotomy, raised IOP was seen in 31% (n=31) of patients. At the end of 1 week, most of the patients (98%) was returned to the normal IOP and 2% of patients shows persistently raised IOP.

Table 4: Raised IOP levels at different intervals in patients after Nd : YAG Laser Capsulotomy

Raised IOP by	1 hr		1 wk		1 month		6 months	
	N	%	N	%	N	%	N	%
>5 mmHg	2	2.0	-	-	-	-	-	-
3 to 4 mmHg	8	8.0	1	1	-	-	-	-
1 to 2 mmHg	21	21.0	1	1	2	2.0	2	2.0
Normal	69	69.0	98	98.0	98	98.0	98	98.0
Total	100	100.0	100	100.0	100	100.0	100	100.0

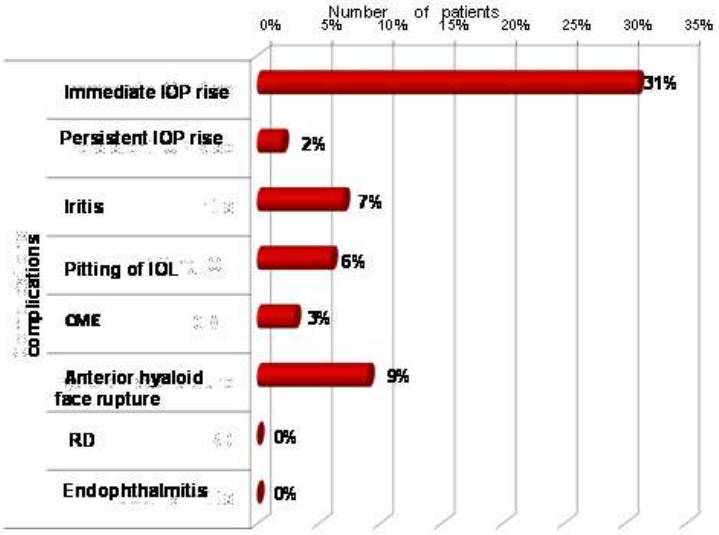


Graph 4: Raised IOP levels at different intervals in patients after Nd : YAG Laser Capsulotomy

Table 4 & Graph 4: Shows that 1hr after Nd : YAG laser capsulotomy, 2% of patients had IOP rise by more than 5 mmHg, 8% of patients by 3 to 4 mmHg and 21% of patients by 1 to 2mmHg. Rest had normal IOP. At 1 week, 1% patient had 3 to 4 mmHg rise while other 1% had 1 to 2 mmHg of IOP rise. At 6 month 2% of patients had persistently raised IOP by 1 to 2 mmHg.

Table 5: Complications in patients after Nd : YAG Laser Capsulotomy.

Complications	Frequency	Percent
Immediate IOP Rise	31	31%
Persistent IOP Rise	2	2%
Iritis	7	7%
Pitting of IOL	6	6%
CME	3	3%
Anterior hyaloid face rupture	9	9%
RD	0	0%
Endophthalmitits	0	0%

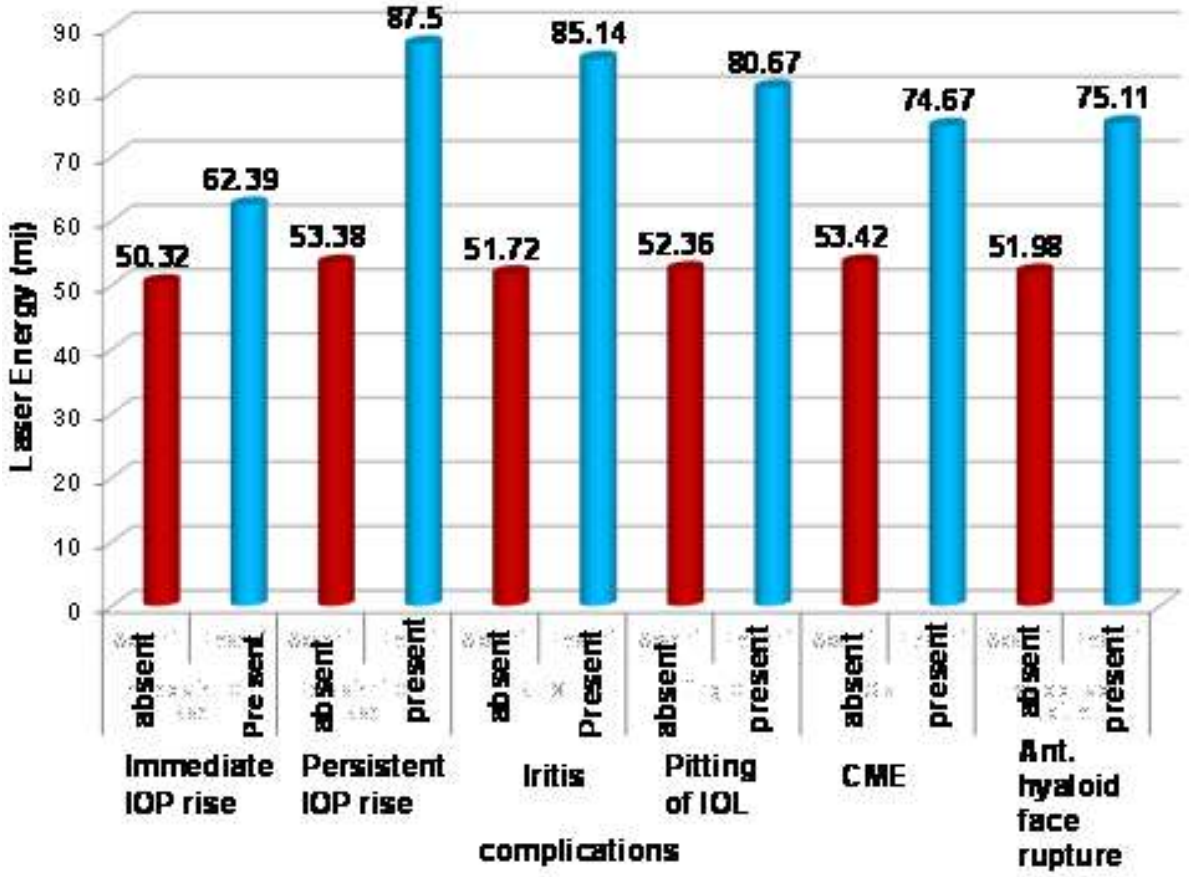


Graph 5: Complications in patients after Nd : YAG Laser Capsulotomy.

Table 5 & Graph 5: Shows most frequently occured complication after Nd:YAG lasercapsulotomy in our study was immediate IOP rise (31%) followed by anterior hyaloids face rupture (9%) , iritis (7%) and pitting of IOL (6%). None of the patient in the present study developed RD and endophthalmitis.

Table 6: Mean summated laser energy in groups with and without complications.

Complications	Group	N	Mean summated laser energy	Std. Deviation	P value
Immediate IOP rise	Absent	69	50.32	22.46	0.010
	Present	31	62.39	18.35	
Persistent IOP rise	Absent	98	53.38	21.6	0.029
	Present	2	87.50	3.54	
Iritis	Absent	93	51.72	20.91	<0.001
	Present	7	85.14	2.97	
Pitting of IOL	Absent	94	52.36	21.45	0.002
	Present	6	80.67	6.44	
CME	Absent	97	53.42	21.92	0.098
	Present	3	74.67	7.09	
Anterior hyaloid face rupture	Absent	91	51.98	21.79	0.002
	Present	9	75.11	7.25	



Graph 6: Mean summated laser energy in groups with and without complications.

Table 6 & Graph 6: Shows that there was a statistically significant ($p<0.01$) difference in the mean summated laser energy level in patients with complication of immediate rise, persistent rise, iritis, pitting of IOL and hyaloid face rupture as compared with patients do not have these

Discussion

Nd : YAG laser capsulotomy is the treatment of choice for PCO [9]. Nd : YAG laser capsulotomy is appears to be safe, non-invasive and effective procedure. In Nd : YAG laser capsulotomy, opening is created in the opacified posterior capsule by focusing pulses of few millijoules of energy posterior to the posterior capsule.

A total of 100 patients having PCO after cataract surgery were evaluated in the present study. Maximum number of patients (37%) were in the age group of 51 to 60 years with mean age in the study was 58 years. Burq *et al*. showed a mean age of 59.5 ± 6.2 years [10].

In present study, male patients were maximum 68% and 32% were females. There was a study done in UK in which 53.8% were females and 46.2% were males [11].

Complications of Nd : YAG laser capsulotomy are discussed below:

Raised Itraocular Pressure

In our study, most frequent complication was rise in IOP. The immediate IOP rise (IOP one hour after Nd : YAG laser capsulotomy) was recorded in 31% of patients, out of which in 21% of patients IOP was increased by 1–2 mmHg, in 8% by 3–4 mmHg and in 2% of patients by more than 5 mmHg. Mean summated laser energy in a group of patients with immediate IOP rise (62.39) was significantly high as compared to group of patients with normal IOP. All these patients with immediate IOP rise were treated with timolol eye drops (beta-blockers) twice a day for one week.

At the end of one week, almost all patients achieved normal IOP except 2% which showed raised IOP. On subsequent follow up, 2% patient showed persistent rise of IOP and were referred to glaucoma clinic. Mean summated laser energy in a group of patients with persistent IOP rise (87.50 mJ) was significantly higher as compared to mean summated laser energy in group of patients with normal IOP (53.38 mJ).

Slomovic and Parrish found that 55% of patients had significantly raised IOP following Nd:YAG laser therapy [12]. In a study by Hasan *et al*., there was a significant rise in IOP of more than 5 mmHg. In all patients, IOP was returned to baseline level after one week of treatment with topical beta-blockers [13].

Awan *et al*. showed that post laser IOP rise was controlled by topical beta-blockers and steroids effectively [14].

Channell and Beckman showed that higher IOP was associated with increased laser energy used during YAG procedures [15]. Silverstone *et al*. observed that higher IOP was associated with larger capsulotomy which required higher energy levels [16].

Ari *et al*. evaluated the effect of energy levels which used for Nd : YAG laser capsulotomy on IOP and macular thickness. The study showed that the severity and duration of IOP rise was less when the total laser energy was less than 80 mJ [17].

However, study by Holweger and Marefat showed that there was no relationship existed between total YAG laser energy used and the rise in IOP [18].

Possible mechanism which contribute to raised IOP is clogging of anterior chamber by particles liberated from posterior capsule breakdown or by inflammatory mediators released from acoustic shock waves which altered the trabecular meshwork.

Rise in IOP following Nd : YAG laser capsulotomy can be prevented by using minimum laser energy and topical beta blockers such as timolol or apraclonidine one hour before and again after the procedure.

Pitting of IOL

In our study, pitting of IOL was seen in 6% of patients. Mean summated laser energy level in patients with pitting of IOL was 80.67 mJ as compared to 52.36 mJ in patients without IOL pitting. The mean summated laser energy was significantly higher (p=0.002) in a group of patients with IOL pitting.

In a study conducted by Bhargava *et al*., the incidence of IOL pitting was 7.8%. The mean total laser energy level in patients with IOL pitting was 61.6 ± 26.4 mJ and was significantly higher as compared to mean total laser nergy level in patients without IOL pitting (42.8 ± 26.7 mJ) [3].

In a study of Burq MA *et al*., the IOL damage following Nd : YAG laser capsulotomy was seen in 19.2% cases [15]. Khan MY *et al*. found IOL pitting in 22.4% cases [19] while in a study of Javed *et al*., it was seen in 3.33% cases.20

Pitting of IOL is usually asymptomatic and does not affect the visual function. IOL damage following capsulotomy may be because of faulty

focusing of laser beam or use of higher laser energy. It was observed that, by using minimum energy and focusing the beam posterior to the posterior capsule we could reduce the pitting of IOL.

Iritis

In our study, iritis was noted in 7% of patients. The mean summated laser energy was significantly higher ($p < 0.001$) in a group of patients with iritis. The mean summated laser energy level in patients with iritis was 85.14 mJ as compared to 51.72 mJ in patients without iritis.

Bhargava *et al*. reported the incidence of iritis was 9.9% and mean summated laser energy level was significantly higher ($p < 0.001$) in a group of patients with iritis.3

The study conducted by Muhammad L *et al*. showed that anterior uveitis was seen in 8.0% cases, [21] while in a study of Javed *et al*, anterior uveitis was seen in 46.2% cases following Nd : YAG laser capsulotomy [22].

In our study, iritis was treated with steroid eye drops which tapered over 2–3 weeks and resulted in resolution of iritis in all patients.

Cystoid Macular Edema

In our study, CME was seen in 3% of patients. Mean summated laser energy in patients with CME was 74.67 mJ versus 53.42 mJ in patients without CME (97%). Mean summated laser energy was not significantly higher in patients with CME ($p=0.098$).

In a study of Bhargava *et al*., incidence of CME was 2.9% and mean total energy level was significantly higher in patients with CME ($p < 0.001$) [3].

A study of Alimanovic-Halilovic E. reported the incidence of CME was 4.1% [23].

In a study of Steinert *et al*., 1.2% of patients developed CME after Nd:YAG laser capsulotomy. According to this study, total laser energy delivered was not a risk factor [24].

A study conducted by Raza reported CME in 3% of patients with aphakic and pseudophakic PCO after Nd : YAG laser capsulotomy [25].

In a study of Khan B *et al*. in 2014, CME was seen in 3.89% of patients [26].

In our study, patients with CME were treated with topical anti-inflammatory drugs for 3 weeks. Patients with CME did not show improvement in VA beyond 6/12.

Anterior Hyaloid Face Rupture

In our study, anterior hyaloid face rupture was noted in 9% of patients, but none of the patient had vitreous in anterior chamber. Mean summated laser energy level in patients with anterior hyaloid face rupture was 75.11 mJ which was significantly higher ($p=0.002$) as compared to 51.98 mJ in patients without rupture of anterior hyaloid face ($n=91$).

Bhargava *et al*. reported the incidence of anterior hyaloid face rupture as 8.8%. Mean summated laser energy level was significantly higher in patients with anterior hyaloid face rupture ($p < 0.001$) [3].

In a study of Alimanovic-Halilovic E, anterior hyaloid face rupture was seen in 7.5% of the cases. He reported that the influence of total laser energy level on complications was statistically significant [23].

Other Complications:

In our study, none of the patient had retinal detachment or endophthalmitis.

A study conducted by Raza reported the incidence of retinal detachment was 2% after Nd:YAG laser capsulotomy [25]. In a study of steinert *et al*, retinal detachment was seen in 0.89% of patients [24].

In a study by Khan WA *et al*., complications like retinal detachment and endophthalmitis were not observed [25].

In a study of Khan B *et al*., incidence of RD was 0.45% and that of endophthalmitis was 0.22% [28].

Conclusion

Nd : YAG laser capsulotomy is the treatment of choice for PCO. Nd : YAG laser capsulotomy results in improvement in visual acuity. Mean initial energy level and mean summated energy level was significantly different for different types of PCO. Mean summated energy level was significantly higher for fibromembranous type of PCO than fibrous and membranous (pearl) types of PCO. Complications with Nd : YAG laser capsulotomy are minimal and transient.

Complications such as raised intraocular pressure, pitting of IOL, iritis, anterior hyaloid face rupture more common if mean summated energy level was high.

The total laser energy delivered were not risk factor for the development of cystoid macular edema.

Healthy pseudophakic eyes generally do not have retinal detachment after Nd : YAG laser capsulotomy. To minimize the complications, lowest possible laser energy level should be used for Nd : YAG laser capsulotomy.

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Penetrating Keratoplasty : A Boon in Different Corneal Diseases to Improve Social Life

Veeresh Korwar[1], Shivanand Reddy[2]

Abstract

Introduction: Corneal Opacity is common cause of ocular morbidity. Occurrence of Corneal blindness alters from nation to nation and from population to population. There is even variation within the developing countries like India. *Aims:* To study the efficacy of penetrating keratoplasty in various corneal disorders which resulted in corneal blindness in my geographical area as well as to improve social life in such poor socioeconomic area. *Materials and Methods:* This is a hospital based prospective study. Total seventy patients diagnosed with non- healing corneal ulcer, corneal perforation, bullous keratopathy, autoimmune disease, infectious keratitis, trauma to the eyeball including chemical burns as well as other combined disorders were indicated for total penetrating keratoplasty. *Results:* Total seventy eyes of seventy patients were operated using the technique of total PKP over a period of 2 years. Among all the conditions Non Healing Corneal ulcer was the main indication. The major post-op complication for which the treatment failed was the persistent epithelial defect. *Conclusion:* Full thickness penetrating keratoplasty was found to be surgical boon and effective tool in the management of various corneal disorders. It was also found that it maintain globe integrity and improve visual acuity as well as social life.

Keywords: Corneal Opacity, Corneal blindness, PKP

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Introduction

Corneal opacity is common cause of ocular morbidity. Occurrence of corneal blindness (CB) alters from nation to nation & from population to population. There is even variation within the developing countries India. In South India, Prevalence of CB in both eyes is 0.11% and in 0.56% in one eye. Corneal blindness remains a liability to the family and community as well. The prevalence ismultifactorial. Frequent etiological factors of corneal opacities such as congenital, trauma, post-surgical, keratitis, developmental, dystrophic and degenerative are avoidable. As the disease is more in rural set up where people are ignorant, often present with complications. Nearly 90% of corneal blindness is avoidable [1]. Corneal transplantation is one of the most common types of human transplant surgery. By replacing a damaged or scarred host cornea and removing it with a clear and clean donor transplant, this technique helps to recover vision in a wide series of corneal diseases. Penetrating keratoplasty (PKP), is a full-thickness corneal transplantation,which is a well-established procedure; however, prolonged identified complications such as post-operative infection, macular and corneal oedema, astigmatism, immune reactions and graft failure remain concerns [2,3]. The main aim of post corneal transplantation is preservation of a clear & clean graft which is maintained with the help of corneal endothelium. PKP will visually rehabilitate lot of patients who were effected from visual impairment due to corneal disorders so the primary objective of this study was to report treatment results of patients,

Author Affiliation: [1,2]Assistant Professor, Dept. of Ophthalmology, Mahadevappa Rampure Medical College, Kalaburagi, Karnataka 585105, India.

Corresponding Author: Veeresh Korwar, Assistant Professor, Dept. of Ophthalmology, Mahadevappa Rampure Medical College, Kalaburagi, Karnataka 585105, India.

E-mail: vkorwar@yahoo.com

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who received a total penetrating keratoplasty for various corneal diseases. We reviewed the surgical treatment, anatomical and functional results, and complications of treatment in this group of patients at our institution in terms of graft survival and visual acuity.

Materials and Methods

This was a hospital based prospective study done in 70 patientsadmitted in ophthalmology ward, department of Ophthalmology, Basaveshwar teaching general hospital, M.R. Medical college, Kalaburagiover a period of twoyears. Patients diagnosed with non-healing corneal ulcer, corneal perforation, bullous keratopathy, autoimmune disease, infectious keratitis, trauma of the eyeball (chemical burns), and other combined disorders were indicated for total penetrating keratoplasty. The main aim of the surgical treatment was complete removal of infected or damaged cornea and recovery of ocular integrity. After a complete ocular examination, total penetrating keratoplasty (diameter ≥ 10.0 mm) was performed. The surgical procedure involved in dissection of affected tissues with a margin of minimum 1.0 mm of non-affected tissue. The size of the corneal graft ranged from 10.0 to 14.0 mm, depending on the extent of corneal necrosis or melting and infiltration of corneal stroma or adjacent ocular tissues. Great precaution was taken to avoid affecting any structures of the irido-corneal angle while preparing the recipient tissues. Data from the medical records included were demographics, medical history, preoperative and post-operative best spectacle corrected visual acuity (BSCVA) measured using the Snellen visual acuity (VA) chart, cure of the disease,visual outcome, structural globe integrityoutcome and complications of surgery, results of microbial tests, post-operative intra-ocular pressure, graft clarity, graft rejection, graft dehiscence traumatic & other complications. All patients signed the informed consent form before any surgical procedure and permission was taken from institutional ethics committee.

Results

Seventy eyes of seventy patients were operated for a period of 2 years using the total PKP technique. This group consisted of 36 females, whose mean age was 66.13 ± 9.94 (range 39 to 80 years), and 34 males, whose mean age was 63.69 ± 14.48 (range 32 to 92 years). There was no statistically significant difference with respect to gender and age between both groups. All primary causes of corneal opacity requiring PKP are presented in Table 1. The main cause of this condition was non-healing corneal ulcer.

The main reason of surgical treatment failure was persistent epithelial defect, observed in 28 (40%) operated eyes,resulting from decreased corneal sensitivity and defective tear production. Repeated total PKP or corneo-scleral patch graft was performed where the tectonic approach was needed more than twice. Reinfection was observed in 17 (24.28%) of eyes that received total PKP surgery.

Table 1: Showing various causes of the corneal opacity

Causes of the corneal opacity	Total (n=70) 100%	Female (n=36) 51.4%	Male (n=34) 49.6
Non Healing Corneal Ulcer	36	15	21
Infectious Keratitis	14	10	4
Autoimmune Disease	10	6	4
Corneal Perforation	8	4	4
Bullous Keratopathy	2	1	1

Table 2: Post-operative complications of total PKP (% in brackets).

Postoperative complications of total PKP	Non-healing Corneal Ulcer n (%) (n=36)	Infectious Keratitis n(%) (n=14)	Autoimmune Disease n (%) (n=10)	Corneal Perforationn (%) n=8)	Bullous Keratopathy n (%) (n=2)
Persistent epithelial defect	20 (55.5)	2 (14.28)	3 (30)	2 (25)	1 (50)
Reinfection	8 (22.2)	5 (35.71)	1 (10)	3 (37.5)	0 (0)
Graft melting	3 (8.33)	4 (25.57)	3 (30)	1 (12.5)	0 (0)
Graft rejection	3 (8.33)	3 (21.4)	0 (0)	2 (25)	1 (50)
Glaucoma	2 (5.55)	0 (0)	3 (30)	0 (0)	0 (0)

Although regular anti-microbial topical and general treatment and repeat tectonic surgery. Graft melting, reported in 11 eyes (15.7%) and commonly preceded by loosening of the sutures and tissue necrosis resulting from infection or immunological mechanisms, was another significant complication of TPK. Early graft rejection, characterised by a whitish, sterile ring or diffuse infiltrates, was present in 9 eyes (12.85%) and treated for infectious corneal ulcerations. Intensive topical and systemic immune-suppressive and anti-inflammatory treatment was administered, leading to scarring and thinning of the peri-limbal tissue. Subsequent consecutive glaucoma or ocular hypertension occurred despite surgically performed iridectomy during tectonic PKP. Peripheral iridectomy was reported in 5 eyes (7.14%) (Table 2).

Discussion

The purpose of PKP is recovery and maintenance of ocular integrity. Post-operative visual acuity and graft clarity are related to many complex physiological & immunological conditions. Anatomical design of the globe does not clarify improvement of vision. Recent developments in corneal graft technology, including donor tissue retrieval, preserve and surgical procedure, have improved the clinical outcome of corneal grafts. Although these advances, immune-mediated corneal graft rejection remains the common cause of corneal graft failure [4].

In our study, we assessed, like Burk and Joussen *et al.* [5]., that the frequent indication for rapid tectonic treatment was infection. However, despite broad-spectrum medical & surgical multistage treatment, even when repeated, the end outcome remained non-satisfactory and was considered as therapeutic failure. Endophthalmitis refractory to antimicrobial and anti-inflammatory treatment required the final procedure of evisceration [6].

Large grafts are regarded as risk factor for immunologic graft failure [7]. Our results agreed by Ti *et al.* [8]. Corneal graft melting, commonly observed in autoimmune disorders complicated by corneal perforations & preceded by loosening of the sutures, which is comparable with the previous study.

The present study observed that important cause of surgical treatment failure was persistent epithelial defect, observed in 28 (40%) operated eyes, resulting from reduced corneal sensitivity and defect tear production delayed epithelialisation or persistent epithelial defect determined important graft failure rate and contributed to the increased rate of ocular surface complications [6].

Surgical interventions with large corneal perforations commonly result in glaucoma. Our results for this complication present less commonly than in previous studies [9]. Total PKP is still not a standard procedure for the treatment of corneal perforations. PKP, lamellar keratoplasties & corneo-oscleral patch grafts remain the more frequently used surgical approach. Systemic immune-suppression, and often multi-drug therapy, is necessary to reduce the risk of graft rejection and the necessity of repeat tectonic surgical treatment [10].

The serial, frequent multistage & combined surgical approach is necessary to achieve final visual acuity outcome [11]. We showed in our study that results of large corneo-scleral grafts are unpredictable. In our opinion, this is commonly the surgical procedure, PKP can able to restore ocular integrity with simultaneous removal of inflammatory membranes, infectious material, direct drug administration & necrotic tissues. Such approach reduces the risk of endophthalmitis&the spread of disease to the globe, while simultaneously increasing the chance of graft survival and significant improvement of visual acuity.

Conclusion

Our study confirms that Full Thickness Penetrating Keratoplasty : Surgical boon and effective tool in management of chronic non-healing microbial corneal ulcer failed to medical treatment, corneal dystrophy and degenerations and various other corneal diseases at my geographical area. It not only eliminates infection but also maintain globe integrity and improve visual acuity and thus improving social life.

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A Clinical Study of Lens Induced Glaucoma

G Narender Reddy[1], G Adarsh Reddy[2]

Abstract

Introduction: Cataract is a major cause of preventable blindness in India accounting to 62.6% [1,2]. A significant proportion of patients still present with advanced cataract leading to complications like Lens-induced glaucoma. There is an ever-increasing backlog of cataract due to the population explosion, increased life expectancy, and low productivity in terms of utilization of the available surgical services. Late reporting for treatment of cataract leading to serious complications like LIG remains one of the most important cause of irreversible loss of vision,. *Aims:* The aim is to study the clinical profile of lens induced glaucoma by intraocular pressure pre and post operatively and to assess the final visual outcome in lens induced glaucoma. *Materials and Methods:* This is a prospective hospital-based study. Eighty cases were studied, encountered during the period of 3 years. *Results:* The total number of cases studied were 80, of which 52 were female and 28 were male showing that occurrence of LIG is more common in females and socioeconomic factors play a major role. Most common type was found to be phacomorphic type of lens induced glaucoma. The occurrence of phacoanaphylactic glaucoma and glaucoma due to subluxation of lens was zero in this study. BCVA at 6 weeks post operatively was 6/18 or better in 57.5% patients. *Conclusion:* Inspite of easy availability of services for cataract surgery socio-economicconditions, poor health education and negligence towards symptoms andwas found to be the main reason for occurrence of LIG. This study signifies that there is a great need to impart health education to thepublic about the importance of timely surgery for better visual outcome.

Keywords: Cataract; Lens-induced glaucoma (LIG); Phacomorphic type.

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Introduction

Cataract is a major cause of preventable blindness in India accounting to 62.6% [1]. A significant proportion of patients still present with advanced cataract leading to complications like Lens-induced glaucoma. Lens-induced glaucoma is a secondary glaucoma in which the crystalline lens is involved in the mechanism of intraocular pressure increase. In the year 1900 Gifford and Von Reuss first described LIG in relation to cataract [2]. Lens-induced glaucoma (LIG) may be due to:

(a) Secondary angle closure from swelling of the lens due to absorption of fluid producing an intumescent cataract (phacomorphic glaucoma).

(b) Occlusion of an open anterior chamber angle by macrophages that has phagocytised lens protein. The lens protein leaks out of the lens capsule of the hypermature cataract (phacolytic glaucoma).

(c) Obstruction of the outflow channels of the anterior chamber angle by inflammatory cells and debris, produced secondary to an immune hypersensitivity reaction to lens protein (phacoanaphylactic glaucoma).

(d) Other types of lens induced glaucomas like lens particle glaucoma and phacotopic glaucoma may also occur.

There is an ever-increasing backlog of cataract due to the population explosion, increased life expectancy, and low productivity in terms of

Author Affiliation: [1]Associate Professor [2]Assistant Professor, Department of Ophthalmology, MNR Medical College and Hospital, Sangareddy, Telangana 502285, India.

Corresponding Author: G Adarsh Reddy, Assistant professor, Department of Ophthalmology, MNR Medical College and Hospital, Sangareddy, Telangana 502285, India.

E-mail: dr.adarshreddy26@gmail.com

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utilization of the available surgical services. Late reporting for treatment of cataract leading to serious complications like LIG remains one of the most important cause of irreversible loss of vision, especially so in the rural population. The uptake of eye care services by the rural community has also been suboptimal in countries like India where LIG is not an uncommon cause of ocular morbidity. Mode of treatment is Small incision cataract surgery with PCIOL, or extracapsular cataract extraction with posterior chamber IOL implantation (ECCE with PCIOL) with or without iridectomy. However, postoperative recovery in these conditions remains guarded. The occurrence of Lens Induced Glaucoma in India has high probability. Thus an analysis of magnitude of lens induced glaucoma and assessment of the visual outcome after cataract surgery in patients attending tertiary care centre like Mamata General Hospital, Khammam would provide important information regarding the morbidity produced by this condition and its effect on incidence of blindness. This study is undertaken to study the clinical profile of various types of lens-induced glaucomas and outcome of current management in a patient seen over a two year period in a tertiary eye hospital in Khammam district of Telangana.

Aims and Objectives

The aim of this dissertation is to study the clinical profile of lens induced glaucoma. To study the intraocular pressure pre and post operatively and to assess the final visual outcome in lens induced glaucoma.

Materials and Methods

This is a prospective hospital-based study in 80 cases encountered during the period from 2015 to 2017 on patients attending the out patient department of Ophthalmology, Mamata General Hospital, Khammam, Telangana from 2015 to 2017 during three year study period.

Inclusion Criteria

All patients were diagnosed as lens induced glaucoma on the basis of clinical symptoms and signs.

Exclusion Criteria

Glaucomas other than those due to phacogenic cause, congenital cataract, traumatic cataract, complicated cataract, secondary cataract and cataract with corneal dystrophy and corneal opacity.

Only those cases which are amenable to follow up were taken up for the study. A detailed case history was taken providing address, age, sex and duration of pain. A detailed clinical examination of both eyes included the visual acuity, status of the lens, peripheral anterior chamber depth by slit lamp biomicroscopy, measurement of intraocular pressure with applanation tonometry, angle of anterior chamber examination by gonioscopy with three mirror Goldmann contact lens. Fundus examination done with a +90.0D lens. Clinical features included pain, loss of vision, redness of the eye, the presence of intumescent, mature or hypermature cataractwith raised intraocular pressure of more than 21 mm Hg. Gonioscopy was notfeasible in some cases due to corneal edema which precluded the visualization ofthe angle of anterior chamber details.

Phacomorphic glaucoma was diagnosed on the basis of acute pain, corneal edema, circumciliary congestion, dilated fixed pupil, intumescent cataract with shallow anterior chamber and on gonioscopy shows narrow angle. Phacolytic glaucoma was diagnosed on the basis of pain, corneal edema, with orwithout anterior chamber flare, deep anterior chamber with open angle ongonioscopy, floating lens particles in AC and or pseudohypopyon. Patients with LIG due to lens displacement (subluxation or dislocation) werediagnosed by history and slit lamp examination may show hypermature morgagnian type of cataract with phacodonesis and iridodonesis.

All cases were treated preoperatively with oral carbonic anhydrase inhibitors, topical Blockers and intravenous mannitol 20% 1 g/kg body weight over 30–40 minutesone hour before surgery to reduce the intraocular pressure. In addition topical steroids were given to reduce the inflammation.

All the patients were explained about the guarded prognosis and an informedconsent was obtained. A small incision cataract surgery was done in all patients andposterior chamber IOL implanted. Sub conjunctival injection of 0.5 CC of dexamethasone 2 mg and gentamycin 20 mg was given at the end of the procedure. The postoperative stay varied from 3 to 5 days with an average of 4 days depending on complications. They were given systemic antibiotics, topical steroid-antibiotic and cycloplegics postoperatively. Systemic and or subconjunctival steroids were given to patients with a severe exudative reaction. At discharge a

detailed examination including uncorrected visual acuity, slit lamp biomicroscopy was performed. Patients were discharged with instruction to use a topical steroid antibiotic combination hourly for 1 week and tapered over 6 weeks duration and were reviewed once in a week. Tonometry, slit lamp biomicroscopy, fundoscopy with +90 D lens and BCVA were examined at the end of 6 weeks. BCVA > 6/18 was considered to be a reasonably good visual recovery and IOP < 21 mm Hg was considered to be within normal range. The results of the study were analyzed in terms of incidence, amount of IOP control preoperatively in response to medical treatment, postoperative IOP range, and visual outcome with respect to the duration of symptoms.

Results

This study includes a total number of 80 cases of lens induced glaucoma patients who were clinically examined to diagnose the type of LIG. Among the 80 cases examined the most common found to be phacomorphic type. There were no phacoanaphylactic glaucoma and phacotopic glaucoma cases recorded in this study period Lens induced glaucoma is a unilateral condition. Among the 80 cases examined right eye was affected in 43 cases and left eye in 37 cases. (Fig. 1).

Table 1: Demographic details of patients in study

Age	Number of cases	Percentage
0–11	-	-
11–20	-	-
21–30	-	-
31–40	-	-
41–50	1	1.25%
51–60	31	38.75%
>60	48	60%
Laterality		
Right eye	43	54
Left eye	37	46
Gender		
Males	28	35
Females	52	65
Duration of symptoms		
< 1 week	43	53.75%
1–2 weeks	26	32.5%
2–4 weeks	9	11.25%
>4 weeks	2	2.5%

Lens induced glaucoma is a disease of old age. Majority of patients seen in this study about 48 patients were above the age group of 60 years. No patients were seen below the age of 48 years in our study. About 31 patients were seen between the age group of 51 to 60. In this study it was observed that LIG was more common in females than males. Among 80 patients observed 52 were female and 28 were male patients. Majority of the

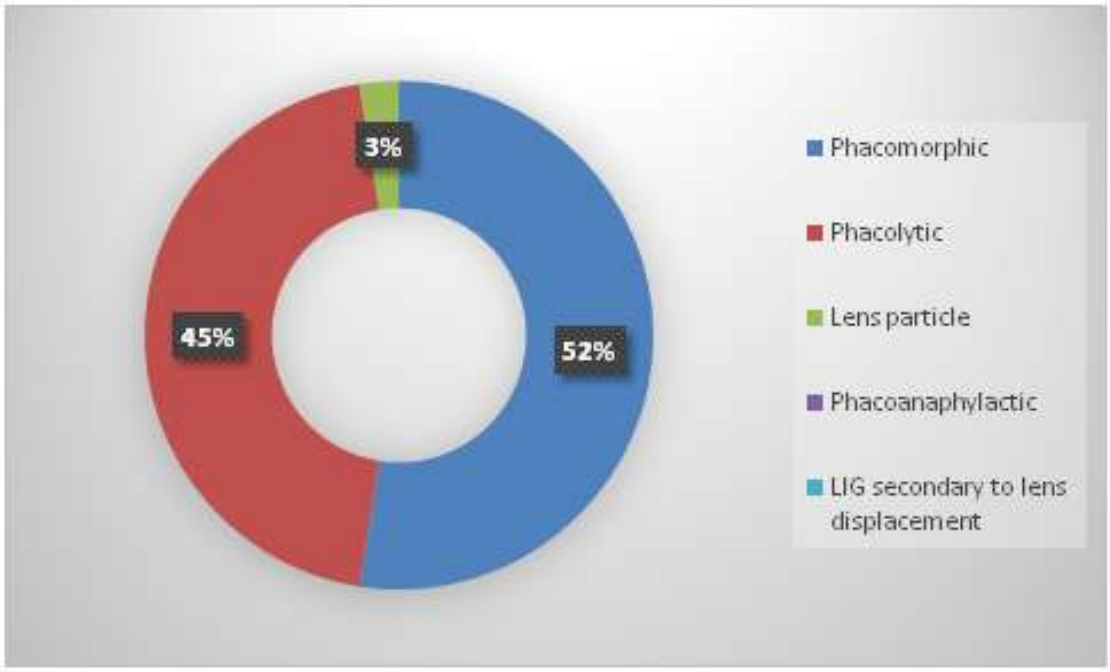

Fig. 1: Number of cases and percentages of various forms of LIGs

patients in this study presented within 1 week of onset of symptoms. About 44 cases out of the 80 cases studied presented within 1 week of onset of symptoms. Rest of the cases had symptoms for more than 1 week (Table 1).

Table 2: Range of intraocularpressure at the time of admission:

Range of IOP	Number of cases	Percentage
21–25	2	2.5%
26–40	44	55%
>41	34	42.5%
Range of IOP in response to medical therapy		
<21 mm of Hg	6	7.5%
21–26 mm of Hg	56	70%
26–30 mm of Hg	12	15%
31–40 mm of Hg	4	5%
>40 mm of Hg	2	2.5%
Range of IOP at 6 weeks		
<21 mm of Hg	70	87.5%
>21 mm of Hg	5	6.25%
Lost for review	5	6.25%

In this study 44 out of 80 cases presented with LIG presented with an IOP in the range of 26–40. About 34 patients presented with IOP more than 41 and 2 cases presented with IOP less than 26. Majority of the cases in this study were operated after the IOP has come down to normal limits using medical therapy. About 62 cases had IOP less than 25 mm of Hg pre-operatively. Rest of the cases had higher pre op IOP of more than 26 mm of Hg. Post operative IOP at 6 weeks was found to be within normal range in 87.5% of patients (Table 2).

Visual Acuity at Presentation Discharge and Follow up

At Presentation

About 74 cases in this study presented with visual acuity of perception of light only. Only about 6 cases had visual acuity of Hand movements.

First Postoperative Week

In the first postoperative week majority of the cases (52.5%%) between 6/24 to 6/60. This was due to post-op iritis and corneal edema which reduced on follow up visits with topical antibiotic-steroid medication. About 22 cases achieved vision better than 6/18 and 16 cases had vision less than 6/60.

At 6 Weeks Post Operatively

Forty six cases out of the 80 cases studied had visual acuity 6/6 to 6/18. About 21 cases had vision between 6/24 to 6/60 and 8 cases with less than 6/60. 5 cases were lost for review at sixth post op week (Fig. 2).

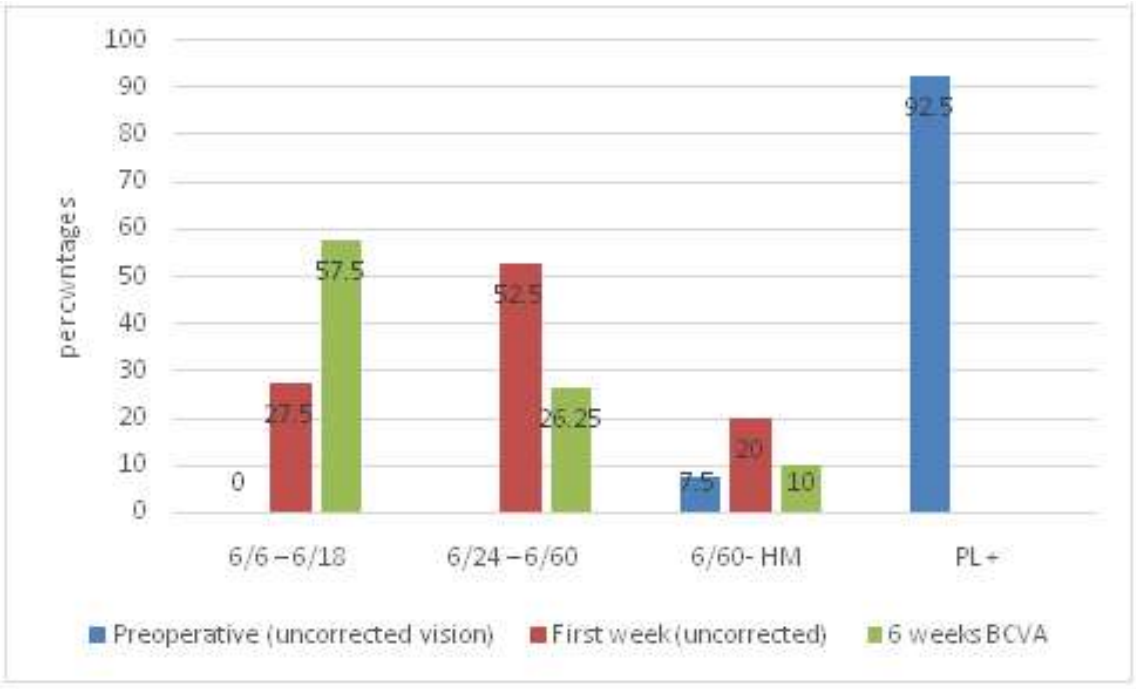

Fig. 2: Percentage of patients with visual acuity at presentation, first post op week and 6 weeks post operatively

Table 3: Visual acuity in relation to duration of symptoms

Duration of symptoms	6/6	6/9	6/12	6/18	6/24	6/36	6/60	CF-HM	LFR
<1 week	11	10	7	5	6	2	1	0	1
1-2 weeks	3	3	4	2	2	4	4	2	2
2- 4 weeks	-	-	-	1	-	-	1	6	1
>4 weeks							1		1

In this study it was noted that 33 cases out of 43 cases who presented within 1 week achieved BCVA of 6/6 – 6/18 at 6 weeks post operatively (Table 3).

Discussion

Lens induced glaucomas occur commonly in India. Though these are clinically distinct entities, they have certain common factors in that they are lens induced, they compromise the function of the optic nerve due to rise of intraocular pressure, cataract surgery is curative in these cases and finally they uniformly share a guarded prognosis.

Incidence of Type of LIG

Lens induced glaucomas are either angle closure or open angle type, resulting due to some disorder of crystalline lens. Phacomorphic glaucoma is defined as secondary angle closure glaucoma due to lens intumescence. An acute rise of IOP can hamper the optic nerve function and may lead to irreversible visual loss if not treated on time. Phacolytic glaucoma is the sudden onset of open angle glaucoma caused by a leaking hypermature cataract. It was observed in this study that patients with phacolytic glaucoma seek medical advice earlier than phacomorphic glaucoma because of the quicker onset of pain, redness and watering in eye with acute elevation of IOP. Lens particle occurs in case of hypermature cataract, traumatic rupture of lens capsule or post operative retained lens matter. Signs include mild to moderate signs of iridocyclitis, deep anterior chamber and very few or no keratic precipitates. The most common form observed in this study was of phacomorphic type constituting 52.5% followed by phacolytic which was 45%. Similar observations were made by other studies where phacomorphic was more common than phacolytic glaucoma (Table 4). Occurrence of various LIGs in the above studies shows variations. Almost always phacomorphic glaucoma is the most common type of LIG among several studies, even in the present study, which is peculiar to the developing countries.

Table 4: Percentages of phacomorphic and phacolytic glaucoma in different studies

		Phacolytic
This study	52.5%	45%
Bhuyan *et al*. [3]	58.86%	33.33%
Sharanabasama *et al*. [4]	86%	14%
Ushalatha *et al*. [5]	62%	38%
Prajna *et al*. [6]	52.7%	47.3%
Pradhan *et al*. [7]	72%	28%
Rijal AP [8]	65%	35%
Murty *et al*. [9]	62%	38%

Phacomorphic and phacolytic glaucoma formed the main bulk of cases constituting 97.5% and lens particle glaucoma constituted 2.5%. Phacoanaphylactic uveitis with secondary glaucoma is seen in cases where there is history of cataract surgery or injury to lens.

As phacomorphic and phacolytic glaucoma are seen following neglected cataract tillit attains hypermaturity and leads to glaucoma, this emphasizes the importance ofearly detection and treatment of cataract. Studies indicated that phacolytic glaucoma occurred more commonly with increasingage probably due to aggregation of high molecular weight proteins over time.

Laterality

Lens induced glaucoma being a secondary glaucoma is a unilateral condition. In thisstudy right eye was effected in 43 (53.75%) of patients and left eye in 37 (46.25%).There was no significant association with the type of LIG. Peram *et al*. showed that 52% cases had LIG in left eye were as 48% cases had LIGin right eye [10]. In a study conducted by Chandrasekhar *et al*. left eye (52.5%) was more affected than right eye (47.5%) [5]. Similar results were found by Rijal and Karki.Left eye was affected in 62% of cases and right eye in 38% cases [8]. They

suggested that there was no preponderance for right eye or left eye.

Incidence in Different Age Groups

In this study the age range was 42–75 years with a mean age of 62.13. The highest number of cases occurred in the age group of more than 60 years (48%). The youngest case in the study group was 42 years old whereas the oldestwas 74 years old.Phacolytic glaucoma was seen more in older age groups than phacomorphicglaucoma. In a study conducted by Bhuyan *et al*. incidence was higher in the fifth decade and above [3]. Similar observations were made by Pradhan *et al* [7]. In a study conducted by Chandrasekhar *et al*. [5] majorityof the cases occurred in the age group of 66–75 years. Sharanabasamma *et al*. [4] found that highest number of cases occurred in the age group of 60–69 years (60%) 42. This correlates well with our study.

A study conducted by Prajna *et al*. [6] stated that age may be a confounding factor inobtaining better visual acuity as in older age groups optic nerve is more susceptibleto damage with increasing intraocular pressure. In our study this could not bestated as most of the patients obtained better visual acuity and no relation was madewith respect to age.

In Lahan study, it has been found that occurrence of LIG is in the age range of 40 to 80 years and highest in the 60 to 69 years age group, indicating that LIGs are acondition of old age [7].

Ushalatha *et al*. stated that onset of senile cataract is earlier in Indian patients andlate reporting for treatment of cataract leads to serious complications like LIG [5].

Occurrence of LIG in the older age group is attributed to the fact that cataract isneglected till they become hyper mature producing symptoms other than diminishedvision and pain requiring immediate medical help. This is because of insidious onset, lack of medical awareness, lack of regular eye check-up, ignorance and limitedresources in developing countries.

Incidence by Sex

The lens induced glaucoma was found to be higher in females than males in ourstudy. This was about 65% with a ratio of 1.8:1 Study conducted by Bhuyan *et al*. [3] also showed that incidence was higher in femalesshowing 60.78% with a ratio of 1.6:136. Ushalatha *et al*. [5] also found that incidence of LIG was more common in females thanmales in a ratio of 2:146. They stated that the reason could be lesser attention received by old women in rural India. This is identical with the studies of Sinha A andPrajan *et al* [6]. Sharanabasamma *et al*. [4] also showed that females had an increased risk of LIG overmales with a ratio of 1.7:1. In this study it was also stated that cataract is more prevalent in females than males. This data was consistent with Punjab study conducted in India and MATLAB study in Bangladesh [6]. In a study conducted by Chandrasekhar *et al*. incidence of LIG was slightly higher infemales (58%) than in males (42%) [5]. Similar results were reported by Rijal AP [8] and Pradhan *et al*. [6]. They observed thatsocio-economic and cultural constraints like most of the patients were daily wageworkers, lack of literacy and dependency on other family members play a roleleading to neglect and late presentation of cataract in females and also females haveshallow anterior chamber, making them more prone to angle closure [6,7]. In this study also female preponderance was found to be due tosocioeconomic repression in this region.

Duration of Symptoms

Majority of cases in our study presented within first week of developing symptoms i.e about 53.75% and rest presented after 1 week (46.25%). Most of the patients in ourstudy were from rural and semi urban areas and of poor socio economicbackground. This might be the cause for late presentation in our study. In a study conducted by Bhuyan *et al*. majority of cases (50.98%) presented withinfirst week of developing symptoms [3]. Pradhan *et al*. in his study found 70% of casespresented after 10 days of onset of symptoms. He stated the reasons for latepresentation were "no escort" and "lack of money" [7]. Chandrasekhar *et al*. found that out of 50 cases 29 cases i.e about 58% presentedwithin first week [5]. In a study conducted by Ushalatha *et al*. about 86% of patients presented to thehospital within 10 days of onset of symptoms 46. A study conducted by sharanabasamma *et al*. [4] stated that reasons for latepresentation were probably because of poverty, ignorance, lack of awareness,facilities for treatment, quackery at peripheries and lack of prompt referral andhelplessness of patients.

In Kothari *et al*. [11] study, they observed that delayed reporting for treatment of cataract leads to serious complications like LIG. In spite of easy availability of services forcataract surgery, reasons

such as poor health education, acceptance of poor visionas part of aging, fear of operation, lesser expectations appear to be the leadingcauses. In their study, Rijal and Karki [8] also found that after taking history of all patients of LIG, all cases are having poor socio-economic conditions due to which negligencetowards symptoms and disease, cases came after longer duration of symptoms 47. Many of them were from far flung areas without any nearby facility of eyecare services. This might be one of the causes for late presentation in our study.In Kothari *et al*. [11] study, they found that longer the duration of symptoms greater thetime to start treatment for LIG.Also many people especially in rural areas take treatment for redness andpain in eyes from some local practitioners who miss the diagnosis initially. It was onlywhen the symptoms became worse, they report to the hospital.Another factor about late reporting found was that the very elderly visuallyhandicapped persons were left to their own fate as no one bothered to bring them tothe hospital.

Range of Iop

At the time of admission

The range of IOP at the time of admission was found to be 26–40 mm of Hg inmajority of patients i.e in 55% of cases. In 42.5% of cases the IOP range was found to be above 40 mm of Hg. Only 2.5% of patients were found to have IOP of 21–26 mm of Hg. According to other studies, most of the patients presented with IOP more than 40 mm of Hg.In a study conducted by Ushalatha *et al*. 76% of cases have IOP more than 30 mmHg. They observed that the height of intraocular pressure has no relationship withduration of attack and type of cataract [5].

Table 5: IOP at presentation in different studies

Studies	<40 mm of Hg	>40 mm of Hg
This study	57.5%	42.5%
Ushalatha *et al*. [5]	30%	70%
Bhuyan *et al*. [3]	39.21%	60.78%

The highest IOP recorded in this study was 58 mm of Hg with applanation tonometerin case of phacolytic glaucoma. There was no significant difference in IOP among LIG subgroups.

In a study conducted by Kothari *et al*. [11], cases with delay in presentationbetween 2 and 4 weeks tend to present with higher IOP. Sharanabasamma *et al*. [4] also found that intraocular pressure tends to be higher if there is a delay inpresentation beyond 30 days than the duration of presentation less than 2 weeks.Though in this study, we observed that height of IOP had no relationship withduration of attack and type of cataract.

Pre Operatively with Medical Therapy

Adequate control of IOP with medical therapy was achieved in 77.5% of cases, the IOP was about within 25 mm of Hg. In a study conducted by Sharanabasamma *et al*. [4] found that the reduction of IOP isgreater after medication for glaucoma. Nevertheless, surgical removal of lens is thedefinitive treatment for Lens induced glaucoma and response to medication is good in these cases. This indicates that in LIG, IOP should be reduced by medical line ofmanagement prior to surgery near-normal to normal to achieve stable IOP postoperativelywithout any further anti-glaucoma medications.

In all these cases IOP decreased with medical management.

At 6 Weeks Post-operatively

The IOP was found to be within normal limits in 87.5% of patients at 6 weeks followup.P value of the post op IOP compared to pre op IOP is 0.0001 showing that IOP reduction was statistically significant after cataract surgery.Ushalatha et al. [5] also found that all the patients maintained a normal postoperativepressure of less than 20 mm Hg at 6 weeks without any additional medical therapy. This correlates with Venkatesh R *et al*. and Singh G studies who too achieved IOP<20 mm Hg in all their patients at the end of follow up period without any antiglaucomamedication [12, 13]. Chandrasekhar *et al*. found that the IOP tends to be higher with the delay inpresentation beyond 2 weeks than the duration of presentation <2 weeks. Thoughthe mean IOP in this study at the last follow up was normal, cases with delay inpresentation of more than 30 days tend to be on higher end of normal [5].

A good intraocular pressure control was defined as a final postoperative intraocularpressure of <21 mmHg, without the need for any anti-glaucoma medication. Those patients who had IOP of more than 21 mm of Hg after surgery which wasabout 6.25% had severe post-operative iritis and exudative membrane in thepupillary area. About 5 patients 6.25% were lost for review at 6 weeks post op.

Visual Acuity

At Presentation

All the patients in this study presented with visual acuity of light perception and accurate projection of rays. As the patients in this study were illiterates and from rural areas, they ignore the mild symptoms and visited the doctor only after gross fall of vision. Also most of the patients had fairly good vision in the other eye leading to negligence till they developed complications in the effected eye. Only 7.5% patients presented with visual acuity of <6/60.

First Post Operative Week

About 27.5% of patients achieved good visual acuity of 6/6–6/18 within one weekpostoperatively. 52.5% patients got 6/24–6/60 vision and only 20% patients had lessthan 6/60 vision.

Best Corrected Visual Acuity at 6 Weeks Post Operatively

The BCVA of 6/6–6/18 at 6 weeks post operative period was obtained in 57.5% ofcases. BCVA of 6/24–6/60 was obtained in 26.25% cases. This was noted in cases that hadlonger duration of symptoms and presented late to the hospital.In a study conducted by Ushalatha *et al*. [5] at 6 weeks BCVA of 6/12 was achieved in 80%, 6/18 to 6/60 in 10% and <6/60 in 12%.

TheMadurai study found that higher number of patients (59.13%) achieved 6/12 or betterthan those less than 6/60 (11.82%). Prajna *et al*. [6] found that 57% of phacomorphic glaucomas and 61% of phacolyticglaucomas attained postoperative corrected visual acuity of 6/12 or better. 10.2% patients with phacomorphic glaucoma and 13.6% patients with phacolytic glaucomahad visual acuity less than 6/60. The poor vision in these patients was found to bedue to compromised optic nerves due to glaucomatous process. Prajna NV *et al*. [6] also showed that BCVA of > 6/60 was achieved in 88% and less than 6/60 in 10%. They documented that the common cause of poor visual outcome wasoptic atrophy. As in our study they too related the final visual acuity more to theduration of attack than to the type of LIG or to the type of surgery, stating that thereis a great need to impart health education to the public about the importance oftimely surgery for better visual outcome.

Visual Outcome in Relation to Duration of Symptoms

In this study, duration of symptoms had a linear relation with best corrected visualacuity at the final follow up. About 76.7% of patients presented within 1 week achieved BCVA between 6/6–6/18. Other cases that presented within one week but did not achieve good vision werefound to have post operative complications like corneal edema, posterior capsularopacification and exudative membrane formation. Sharanabasamma *et al*. [4] found that good visual acuity was achieved in casespresented within 2 weeks (72%) was more than cases presented beyond 2 weeks (16%). This study shows linear relationship between the symptom duration and

BCVA at final follow up Sharanabasamma *et al*. also studied the influence of inflammation on final visualacuity. Visual acuity achieved in cases with mild to moderate inflammation (52.78%) was better than cases with severe to very severe inflammation (21.43%). Prajna *et al*. [6] also analyzed the role of age and sex of the patient including theduration of glaucomatous process in the visual outcome. They found that patientsabove the age of 60 years had a marginally significant increase in odds of obtaininga poor visual acuity.

Visual Outcome in Relation to Pre op IOP

About 35% patients who presented with less than 40 mm of Hg achieved good visualacuity of 6/6–6/18. 41.1% of patients who presented with IOP more than 40 mm Hg achieved good visual acuity of 6/12 or better. In our study poor visual acuity was not related to thepre op IOP. About 20.5% patients presenting with IOP above 40 mm Hg had vision 6/60 or less. A study conducted by Chandrasekhar *et al.* showed that cases with IOP atpresentation <30 mm of Hg achieved good visual acuity (60%) than cases with IOP more than 40 mm of Hg (20%).The Madurai study found no significant association between level of preoperative IOP and final visual acuity [6].

Post op Complications

Most of the patients in our study had mild post operative complications like striate keratopathy and iritis which subsided on hourly institution of topical steroids. Few cases had pupillary capture of PCIOL. Other cases with low visual acuity at 6 weeks post op were found to have exudative membrane in the pupillary area, posterior capsular opacification and pigment deposits on the IOL. 4 of the patients inour study were left aphakic due to posterior capsular

rupture. At 6 weeks post opfundus examination showed normal optic disc in majority of the patients. In 2 cases of the cases glaucomatous optic atrophy was seen which was correlated to theduration of symptoms. Patients who presented beyond 2 weeks had less visualacuity compared to those presented within 2 weeks. Shranabasamma *et al*. also observed similar results where optic disc was normal in 58% of patients at the last follow up. Glaucomatous disc damage was found in 42%cases. Optic disc damage was found to be more in patients presented beyond 2 weeks (64.28%) and especially beyond 30 days (100%) than in cases presentedbefore 2 weeks 42. According to Ushalatha *et al*. [5] 8% cases have developed glaucomatous optic atrophyand 4% developed atrophic bulbi due to delay in attending the hospital.In a study conducted by prajna *et al*. [6] postoperative poor visual acuity was found to bedue to glaucomatous optic atrophy and severe persistent postoperative uveitis withresultant cystoids changes in the macula.

Conclusion

Most common type was found to be phacomorphic type of lens induced glaucoma. The occurrence of phacoanaphylactic glaucoma and glaucoma due to subluxation of lens was zero. BCVA at 6 weeks post operatively was 6/18 or better in 57.5% patients. Visual outcome bears a definite relationship with the duration of symptoms. BCVA of 6/6–6/18 in 77.6% of cases was attained in patients with duration of symptoms of less than one week. The postoperative IOP was within normal limits in 87.5% of patients. In spite of easy availability of services for cataract surgery socio-economic conditions, poor health education and negligence towards symptoms andwas found to be the main reason for occurrence of LIG. This study signifies that there is a great need to impart health education to the public about the importance of timely surgery for better visual outcome.

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Clinical study of Vernal Kerato Conjunctivitis

Jyothi N Sanganal[1], Manish K[2]

Abstract

Objectives: To study the variations in epidemiological characteristics, clinical features, disease process and various modalities of management in VKC. *Materials and Methods:* A hospital based prospective study of 150 patients presenting with symptoms of allergic conjunctivitis was done at Out Patient Department of Ophthalmology, ESIC Medical College, Gulbarga, from July 2018 to June 2019. Multiple epidemiological (age, sex) and clinical parameters (type, symptoms, treatment, failure of treatment) were studied. All patients were appropriately managed and reviewed once in fortnight and follow up ranged from a minimum of 3 months to 6 months. *Results:* In our study, out of 150 patients who presented with symptoms of VKC, predominance of male that was seen in 74%compared to females being 26%. Mean age affected was found to be in range of 10-16 years 66%. In our study 68% patients had seasonal symptoms, 32% complained perennial symptoms, 30% patients had personal or family history of allergic diseases, asthma and rhinitis being common and maximum cases were reported during January to April. In our study, 100% patients complained of itching, 52% had redness, 32% had ropy discharge, 24% complained of photophobia, 18% had burning sensation, 12% had watering. The disease pattern consisted of palpebral form in 63.3%, bulbar form in 21.3% and mixed form in 23% patients. Corneal involvement was seen in 12 (13.33%) patients. Superficial punctate keratitis was the commonest presentation. Bulbar form of the disease was found to be sensitive to Sodium cromoglycate alone. Olopatadine hydrochloride 0.1% E/d and antihistamine E/d were used along with steroids in patients and proved beneficial for long term. *Conclusion:* VKC is a common form of conjunctivitis in a tropical country like ours. It is a bilateral, recurrent debilitating form of disease found to affect young males below 16 years. VKC is associated with other systemic atopy or family history of allergic disorders. It can be successfully treated with available antiallergic treatment with good prognosis.

Keywords: VKC; OPD.

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Introduction

Vernal Keratoconjunctivitis is a recurrent bilateral chronic allergic inflammatory disease of the ocular surface. The distribution of vernal conjunctivitis is worldwide accounting from 0.1% to 0.5% of patients with ocular problems. It is observed in children and young adults presenting with complaints of severe itching and photophobia accompanied by ocular discomfort and lacrimation. [1,2].

It is a chronic ocular allergy that affects mostly children and adolescents living in warm or hot climatic conditions [3]. VKC primarily affects boys more than girls in the first decade of life around the age of 7 years. The male: female ratio observed is 2.3:1 [3]. The onset of the disease is usually after the age of 5 years and resolves around puberty, only rarely persisting beyond the age of 25 years [4].

Various exogenous as well as endogenous causes have been reported to be associated with the etiopathogenesis of VKC. An immune mechanism is found to be involved in its development as suggested by various studies [5]. The disease is usually seasonal, lasting from the beginning of spring until autumn. Its predominance during the high pollen season lends credence to the widely accepted hypothesis that VKC is an

Author Affiliation: [1]Assistant Professor, Dept. of Ophthalmology, ESIC Medical College, Gulbarga, Karnataka 585106, India. [2]Associate Professor, Dept. of Forensic Medicine, Gulbarga Institute of Medical Sciences, Gulbarga, Karnataka 585101, India.

Corresponding Author: Manish K, Associate Professor, Dept. of Forensic Medicine, Gulbarga Institute of Medical Sciences, Gulbarga, Karnataka 585101, India.

E-mail: manikemster@gmail.com

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immunologically mediated, hypersensitive reaction to environmental antigens [3].

VKC occurs frequently and has extremely annoying symptoms that has led to absences from school and work and on addition to this compliance to its treatment plays important role. With the background knowledge of nature of the disease, the patient has to be educated regarding what to expect and the pit falls of management. Consequently this study was undertaken to know the variations in epidemiological characteristics, clinical features, disease process and various modalities of management in VKC.

Materials and Methods

The present study was a Hospital based prospective study. It was carried out on 150 patients with symptoms of allergic conjunctivitis attending the outpatient department of the Department of Ophthalmology attached to ESIC Medical College, Gulbarga, Karnataka from January 2019 to June 2019. It was carried out after obtaining permission from ethical committee of the institution, and consent from the study participants.

All patients with history of itching, photophobia and mucous discharge were included in the study. Patients who were non compliant, who were not available for follow up for required period of time and those with other ocular disorder like glaucoma, infectious keratitis, posterior segment abnormality were excluded from the study.

Using a preformed proforma, history was obtained from each patient with special attention to characteristic symptoms, duration of symptoms, occurrence of symptoms, whether seasonal or perennial, family and personal history of allergy and past treatment. Patients underwent a detailed clinicalexamination; unaided visual acuity was determined separately for each eye. The BCVA was recorded after refraction, slit lamp examination with fluorescein staining, measuring of intraocular pressure using an applanation tonometer and fundus examination. Patients were divided mild,moderate and severe based on signs and symptoms (Table 1). Depending severity patients were divided in two treatment groups andtreated systematically (Table 2).

Results

Out 0f 150 patients of VKC, 111 (73.33%) were male and 39 (26.67%) were female. Table 3 displays the age and sex distribution at the onset of VKC. The highest incidence of VKC occurred in the age group 11–16 years that is 66 cases (44%). Table 4 shows periodic variation in VKC with highest cases seen with seasonal variation 102 cases (68%). As shown in Table 4 according to symptom profile, all cases presented with itching while redness was seen in 78 (52%) cases and history of photophobia in 36 cases (24%), ropy discharge in 48 cases (32%), and watering and burning sensation in 27 (18%) and in 18 (12%) of cases respectively.

Table 1: Table showing signs and symptoms in VKC and grading

Signs and Symptoms	Mild	Moderate	Severe
Itching	Occasionally feel like rubbing	Occasionally rubbing eyes	rubbing eyes daily
Burning	Occasional	Daily with occasional closing	Close eyes Daily
Discharge	Occasionally wipe eyes	Wipe eyes daily	Wipe eyes several times a day
Papillae	≤1 mm- ≥3 mm	≥1 mm - ≤3 mm	≥3 mm
Limabal involvement	Limbal involvement ≤1 bulbar quadrant	1 to 3 bulbar quadrant	All 4 quadrants
Superficial punctate keartitis	None	<1/2 cornea	>1/2 cornea

Table 2: Table showing treatment groups

Treatment group	Treatment
I	Sodium Cromoglycate 4% E/d HS + Olopatadine hydrochloride 0.1% E/d BD + Topical Anti Histamines E/d 5 times daily.
II	Topical Fluoromethalone E/d TID + Olopatadine hydrochloride 0.1% E/d BD + Topical Anti Histamines E/d 5 times daily.
III	Topical Fluoromethalone E/d TID + Olopatadine hydrochloride 0.1% E/d BD + Topical Anti Histamines E/d 5 times daily + Antibiotic E/d +/- (Cycloplegics)

Disease pattern as described in (Table 5) depicts palpebral form of VKC was seen in 95 cases (63.33%), bulbar form in 32 cases (21.33%), and mixed form in 23 cases (15.33%). Table 6 describes the presence of various ocular signs in cases examined, All cases (100%) had papillae on upper palpebral conjunctiva, 50 cases (34.67%) had limbal invovement, 20 cases (13.33%) had SPKs and limbal papillae, Corneal complications as shown in Table 7 occurred in 20 (13.33%) patients.

Patients with VKC often give a history of allergy or of atopic diseases such as allergic rhinitis, asthma, or hay fever, but in the present study, coexisting allergic conditions could be detected in only 45 (30%) patients as shown in Table 8.

Table 3: Table showing age wise and sex wise prevalence in VKC

Age of the pts	Males	Females	
3–9 yrs	31	8	39 (26%)
10–16yrs	45	21	66 (44%)
17–23yrs	24	6	30 (20%)
23–30yrs	11	4	15 (10%)
Total	111 (74%)	39 (26%)	150

Table 4: Periodic variation in VKC

Periodic variation	No. of pts
Seasonal variation	102 (68%)
Perrineal variation	48 (32%)
Total	150

Table 5: Table showing incidence of symptoms

Symptoms	No. of pts presented
Itching	150 (100%)
Redness	78 (52%)
Photophobia	36 (24%)
Ropy discharge	48 (32%)
Burning sensation	27 (18%)
Watering	18 (12%)

Table 6: Table showing disease pattern

Disease pattern	No. of patients
Palpebral form	95 (63.33%)
Bulbar form	32 (21.33%)
Mixed	23 (16.42)
Total	150

Table 7: Table showing various ocular signs

Signs and symptoms	No. of patients
Papillae	150 (100%)
Limabal involvement	50 (33.33%)
Superficial punctate keratitis	12 (13.33%)

Table 8: Table showing association with allergic disorders

Coexisting allergic disorders	No of patients
History of allergic disorders	45 (30%)
With no history of allergic disorders	115 (76.66%)
Total	150

All the cases were divided depending on their severity (Table 2) in to mild, moderate and severe degree. Out of 150, we categorized 52 cases as mild VKC, 86 cases as moderate 12 patients as severe grade (Table 9) and treated accordingly (Table 10).

Table 9: Table showing grading of patients depending on signs and symptoms

Signs and symptoms	No. of Patients	Mild	Moderate	Severe
Itching	150	52	86	12
Burning	150	52	86	12
Discharge	48	1	35	12
Papillae	150	52	86	12
Limabal involvement	50	8	30	12
Superficial punctate keratitis	12	3	4	5

Table 10: Table showing treatment groups

Treatment group	Treatment	No. of cases
I	Sodium Cromoglycate 4% E/d HS + Olopatadine hydrochloride 0.1% E/d BD + Topical Anti Histamines E/d 5 times daily.	52 (34.66%)
II	Topical Fluoromethalone E/d TID + Olopatadine hydrochloride 0.1% E/d BD+ Topical Anti Histamines E/d 5 times daily.	86 (57.33%)
III	Topical Fluoromethalone E/d TID + Olopatadine hydrochloride 0.1% E/d BD + Topical Anti Histamines E/d 5 times daily + Antibiotic E/d +/- (Cycloplegics)	12 (8%)
Total		150

Table 11: Table showing outcome of disease

Treatment group	Improved cases	Uncontrolled cases	
With no steroids (Group I)	45 (30%)	7 (4.66)	52 (34.66%)
Steroids (Group II)	83 (55.33%)	3 (2%)	86 (57.33%)
With antibiotics(Group III)	12 (8%)	0	12 (8%)
Total	140	10	150

All patients except 10 showed moderate to good control over a period of one month. Among 10 patients who were not under control, 3 patients belonged to group II and 7 belonged to group1 (Table 11). Out of 3 patients in Group II. 2 had lost for follow up and one progressed to grade III and treated accordingly. Out of 7 patients in Group I. 3 progressed to Grade III. 1 lost for follow up. 2 were non compliant. And 1 developed shield ulcer that is progressed to Grade III.

Z test for proportions, $Z = 1.19$, $p>0.05$

Discussion

In our study, out of 150 patients who presented with symptoms of VKC, predominance of male that was seen in 74%compared to females being 26%. Similar results were obtained by Baryishak Y.R, Zavaro *et al*. study showed incidence of 73.0% males being affected by VKC [5].

Mean age affected was found to be 66% in range of 10-16 years, Similar results were observed by Bisht *et al*. in his study, the mean age as 14.3 years (range 7-20 years) [6]. The notable difference between sexes, and the resolution of the disease with puberty are features that have persistently suggested that hormonal factors play a part in the development of VKC (Bonini *et al*.) [7] 68% patients had seasonal symptoms, 32% complained perennial symptoms, 30% patients had personal or family history of allergic diseases, asthma and rhinitis being common and maximum cases were reported during January to April.

These results correlatedwith study done by Ujwala S Saboo and associates showing 64% seasonal, 36% perennial occurrence, 4.91% of patients had personal or family history of allergy and highest incidence of disease was noted in month of May, [8] which corresponds to hot dry weather in southern part of India

In this study, 100% patients complained of itching, 52% had redness, 32% had ropy discharge, 24% complained of photophobia, 18% had burning sensation, 12% had watering. Similar results were observed by Bisht R. Goyal A. *et al* [6]. The diseasepattern consisted of palpebral form in 63.3%, bulbar form in 21.3% and mixed form in 23% patients. Study done by Togby showed mixed form to be predominant about 71.4% followed by palpebral form 17.4%, and bulbar form 11.2% [9].

The multi centric study from Italy reported predominance of limbal form about 53.8%, [10] whereas Ukponmwan reported 82.6% cases with palpebral presentation in Nigeria [11]. This signifies that the prevalence of subtypes of VKC is different in various parts of the world.

VKC can cause various corneal complications leading to decreased vision. In our study, corneal involvement was seen in 12 (13.33%) patients. Superficial punctate keratitis was the commonest presentation. We noted moderate vision loss in 8.89% patients. Bonini *et al*., noted permanent visual loss in 6% of patients due to corneal complications and scarring [7].

Pulse steroid therapy was found to be a safe and effective method of management of vernal conjunctivitis in our study. Bielory BP and associates found similar observations [12].

Topical soft corticosteroids are the most effective treatment for moderate to severe forms of VKC because of their broad and early interference with the inflammatory cascade with less side effects. Bulbar form of the disease was found to be sensitive to Sodium cromoglycate alone.

Dahan and associates observed improvement in 90% subjective and 58% objective signs of bulbar form of the disease treated with sodium cromoglycate [13].

Olopatadine hydrochloride 0.1% E/d and antihistamine E/d were used along with steroids in patients and proved beneficial for long term treatment. Corum *et al*, reported that 2 monthstreatment with Olopatadine hydrochloride 0.1% relieves the signs and symptoms of VKC [14].

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Original Article

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Prevalence of Cataract Type in Relation to Axial Length in Subjects with Myopia in Southern Part of Rajasthan

Hanumant Singh[1], Mahima Panwar[2]

Abstract

Background: Cataract is a leading disease with increasing age of visual impairment in and around the Southern part of Rajasthan. Hence, this study was carried out for understanding the type as well as densities of cataract in relation to axial length in cases with myopia in southern part of Rajasthan. *Methods:* This prospective randomized observational case-control study of 200 eyes in the age group of > 40 years with age-related cataracts was carried out. Myopia subjects with an AXL of > 24.0 mm were taken as cases (n=100 eyes) and subjects with emmetropia with AXL ranging between 21.0–23.99 mm were considered as controls (n = 100 eyes), fulfilling our inclusion and exclusion criteria. *Results:* On comparison with emmetropic eyes and myopic eyes, they were associated with an increased prevalence of nuclear (OR: 3.64, 95% confidence interval [CI]: 3.72–6.69), but not with cortical (OR: 0.58, 95% CI: 0.68–1.08) and PSC (OR: 0.40, 95% CI: 0.56-1.01). On myopia, there was a significant association between myopia and nuclear cataract (OR: 3.8, 95% CI 2.9–5.2). Subjects between 40–50 years of age, nuclear sclerosis was predominant. *Conclusion:* Myopic eyes were associated with increased prevalence of nuclear cataract and the density of cataract was also higher in patients with higher axial length. There was significant association between axial length and PSCC ($p<0.05$).

Keywords: Myopia; Emmetropia; Cataract; Axial Length

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Introduction

Cataract is a single largest cause of visual impairment with increasing age of visual impairment in both the developing and developed countries. As the life expectancy is increasing the prevalence of senile cataract is also increasing in an aging population, the impact of age related cataract are expected to increase. Hence, understanding etiopathogenesis and risk factors for cataract is important to eliminate avoidable blindness due to cataract. It is well documented in population based studies that nuclear cataract, may lead to a myopic shift in refraction with age. However, it is not clear whether myopia predisposes to cataract formation or the other way. In our project on visual impairment, myopia was associated to the development of cortical cataract, whereas this association was not observed in any other population based studies. It is reported that early-onset myopia (defined as self-reported history of distance spectacle use before the age of 20 years) was related to posterior subcapsular (PSC) cataract, whereas non significant association was found between incident PSC cataract and baseline refraction. Even if myopia is considered a risk factor for certain subtypes of cataract, it is not clear if a threshold effect exists.

The relationship between cataract and axial length (AL) is less studied. Tanjong Pagar [2] showed no correlation between any cataract subtype and axial length. However, Kubo *et al*. [3] reported an increased severity of nuclear cataract was associated with a longer axial length. Lim *et al*. [4] stated that a longer axial length was a risk factor for progression of lenticular opacity.

Author Affiliation: [1]Resident, [2]Assistant Professor, Department of Ophthalmology, Ravindra Nath Tagore Medical College, Udaipur, Rajasthan 313001, India.

Corresponding Author: Mahima Panwar, Assistant Professor, Department of Ophthalmology, Ravindra Nath Tagore Medical College, Udaipur, Rajasthan 313001, India.

E-mail: sbapna.1@gmail.com

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Studies on data of axial length showed further insights into the cause of mechanisms of the relationship of myopia with cataract [5,6]. In this study we aim to describe the associations of axial length and myopia with age related cataract, and to determine in a population based study of people aged 40 to 80 years the threshold effect of refraction on age-related cataract.

Aims and Objective

To study the prevalence of type as well as densities of cataract in relation to axial length in cases with myopia in southern part of Rajasthan.

Materials and Methods

This prospective randomized observational case-control study was conducted on patients attending the outdoor of Department of Ophthalmology in RNT Medical College, Udaipur between November 2017–October 2018. Every patient was screened with the inclusion and exclusion criteria of this study and detailed history taking, followed by complete ocular examination.

- External ocular examination
- Visual acuity distance and for near vision with snellens chart
- Refraction and correction
- Slit lamp examination
- Intraocular pressure
- Fundoscopy
- A scan
- B scan

Inclusion Criteria

The study includes all myopic patients (axial length > 24 mm), age groups above 40 yrs, came to eye OPD for cataract surgery.

Exclusion Criteria

The study will exclude.

- Eyes with ocular risk factors for the development of cataract (eg, retinitis pigmentosa)
- Diabetes/raised IOP /ocular trauma
- Retinal detachment
- Uveitis and vitreous hemorrhage
- Patient using systemic or topical steroid for various reasons for >3 months
- Those with history of intraocular surgery
- Lasik/PRK
- Prophylactic laser photocoagulation or cryo-treatment
- Pupillary dilation < 7 mm.

Those patients were considered as study/case subjects who were having an AXL <21 mm; using systemic or topical steroids for various reasons for >3 months, with a h/o intraocular surgery; ocular trauma; raised intraocular pressure; uveitis; pseudoexfoliation; diabetes mellitus; total cataract; LASIK/PRK; prophylactic laser photocoagulation; or cryo-treatment were excluded from the study.

Methods of data collection (Sampling procedure)

Two hundred eyes in the age group of ≥ 40 years with age-related cataracts were studied. Myopia subjects with an AXL of ≥ 24.0 mm were taken as cases (n = 100 eyes) and subjects with emmetropia with AXL ranging between 21.0–23.99 mm were considered as controls (n = 100 eyes). Informed consent was taken from all the cases before enrolling them in the study. Healthy eyes with uncomplicated cataracts of subjects 40 years and older were included in the study.

An analysis of each cataract type in cases with myopia and emmetropia, and the resulting odds ratio (OR) at 95% confidence intervals are divided into two groups. We assessed the probability of occurrence of a nuclear cataract with other types of cataract in cases with myopia and those with emmetropia. The probability of occurrence of nuclear cataract and PSC with other types of cataract; and nuclear cataract versus PSC in subjects with myopia and emmetropia was analyzed. Prevalence of different types of cataract according to AXL measurements in cases with myopia only were studied. The prevalence of different grades of nuclear cataract according to AXL measurements in cases with myopia were analyzed.

A prospective observational case-control study fulfilling the mentioned inclusion and exclusion criteria with age group of 40 years and above with age-related cataracts for objective assessment of cataract-Slit lamp Based classification system.

Lens Opacity classification system-II (LOCS - ll) was used.

Ophthalmological Examination

Patients entering the record are taken detailed history and subjected to following ophthalmic assessment:

- *Refraction*

An initial estimate of the refraction (Sphere, cylinder and axis) was measured using an autorefractor. Refraction was determined by subjective refraction. Autorefraction readings were used as the starting point and refinement of sphere, cylinder and axis was performed until the best corrected visual acuity was obtained. Refractive error was expressed as spherical equivalent (SE). Emmetropia was defined as -0.5 diopter (D) ≤ SE + 0.5 diopter. Hyperopia was defined as SE > + 0.5D. Myopia was defined as SE less than –0.5 D.

- *NCT*

Non-contact tonometers (NCT) use a puff of air to create an applanation event on the cornea, the changes in the characteristics of the corneal light reflex so produced, being measured electronically. The NCT, with its associated low cross infection risk, was used in this study to record intraocular pressure with good sensitivity and specificity and good patient compliance.

- *Slit lamp examination*

We examined the patient after dilatation of the pupil with 1% tropicamide and 2.5% phenylephrine hydrochloride eye drops, with a slit-lamp. Details of lens opacity was noted for its presence or absence (if present - type of cataract and density of nuclear cataract was noted). The methodology adopted for evaluating the type and density of the cataract was standardized in terms of illumination and magnification. The type of cataract was categorized in the following manner: cortical, nuclear, PSC and a combination as mixed cataract. Clear lens assessment was performed using oblique illumination. To avoid biasness and to maintain reliability and consistency single observer was used. Retroillumination was used to assess cortical cataract and PSC cataract. The retroillumination slit-lamp beam was fixed at 14 mm height, 1 mm width, using a 12x magnification. The illumination was kept at 100%. Nuclear cataract was assessed under oblique illumination and a slit beam was fixed at 14 mm height and 1 mm width, with 12x magnification and the slit-lamp was placed at an angle of 30 to 45°. The cortical and PSC cataract opacities appeared as darkly shaded interruptions of reddish-orange reflex. Observations and measurements were noted for each eye. Density of the nucleus was measured according to the LOCS-II classification. The rating scheme for nuclear density was primarily based on the consistency/color of the nucleus: grade 1: soft; grade 2: semi-soft (white, or yellowish white or yellowish green); grade 3: medium (yellow); grade 4: hard nuclei (amber color); grade 5: rock hard (black color or brunescent).

- *Fundoscopy*

Dilated fundus examination using a slit lamp biomicroscope and a non contact 78D lens was done to rule out exclusion criterion like DM retinopathy/ glaucoma, retinal detachment, retinitis pigmentosa.

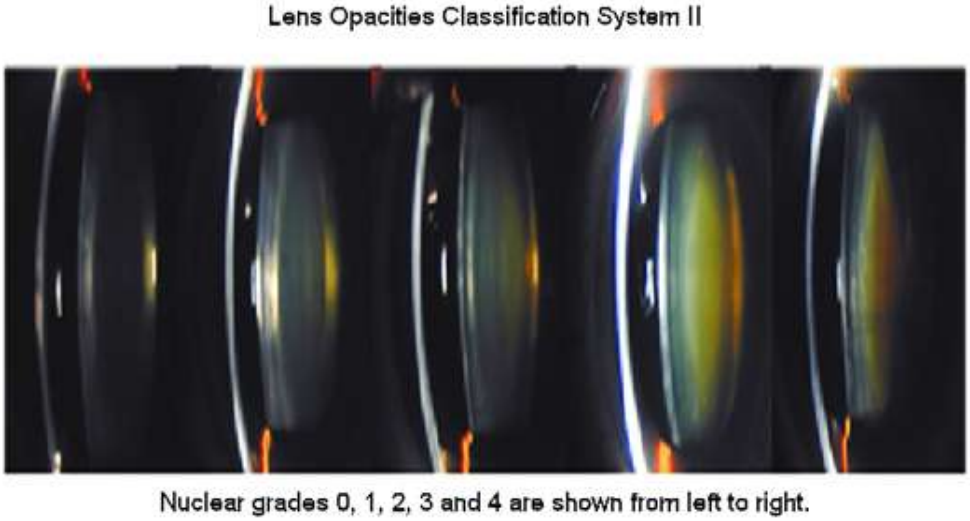


Fig. 1:

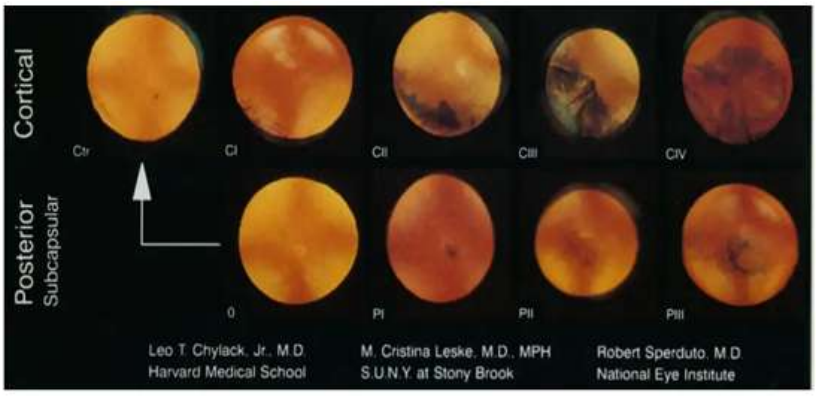


Fig. 2: Cortical and PSC Cataracts in Retroillumination

- *A scan*

Before dilatation of the pupil an AXL measurement was taken. Ocular dimensions including AXL were measured with an A-scan ultrasound with a high frequency (10 MHz) and low energy ultrasonic pulses emitted by the probe. AXL was determined until five acceptable values were generated for each eye and an average value was obtained from this.

- B scan - if fundoscopy is not possible

Fig. 3: A-scan probe

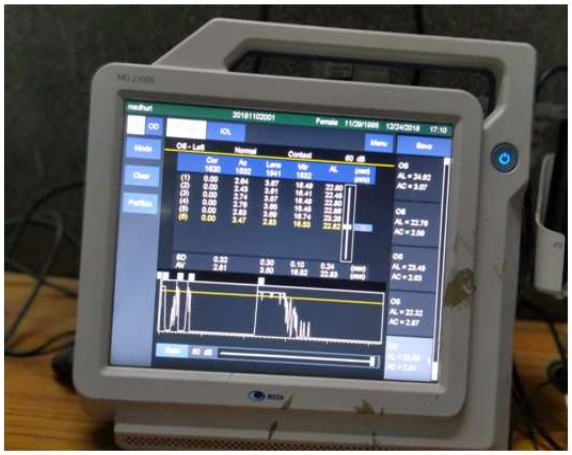


Fig. 4: A-scan Biometry

Results

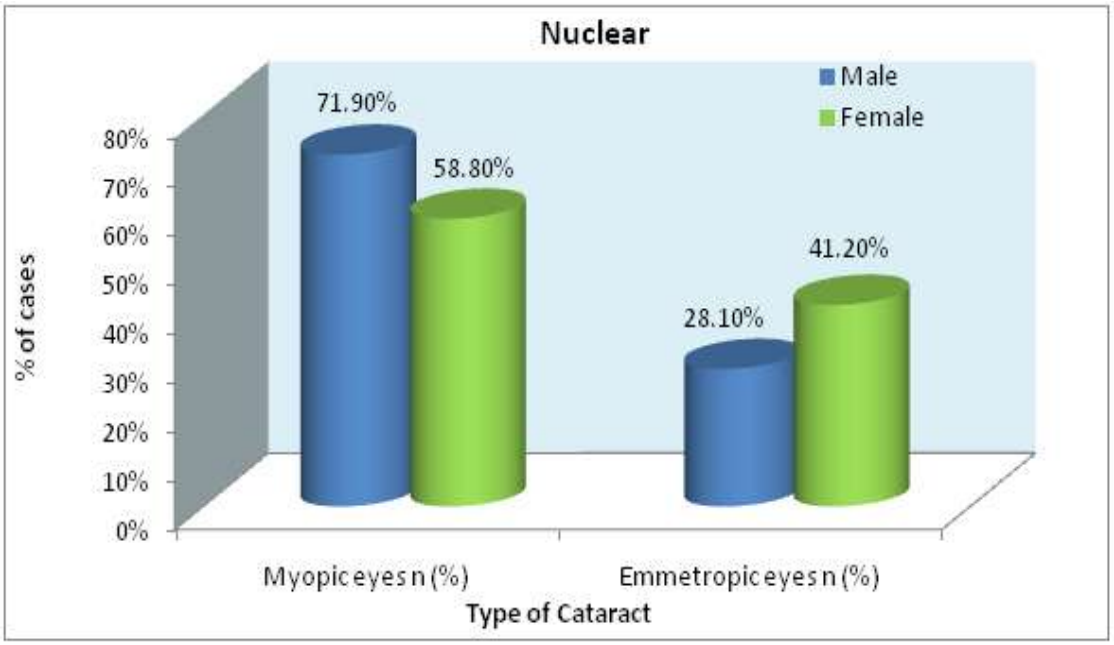
Sixty one percent of the subjects had nuclear cataract, 1% had Cortical Cataract, 6.0% had PSC, 18% subjects had Nuclear + PSC and 14% had Mixed Cataract. In patients aged above 40 years, nuclear cataract was more often encountered with myopia (Table 1).

Table 1: Prevalence of types of cataracts in Emmetropic and myopic group

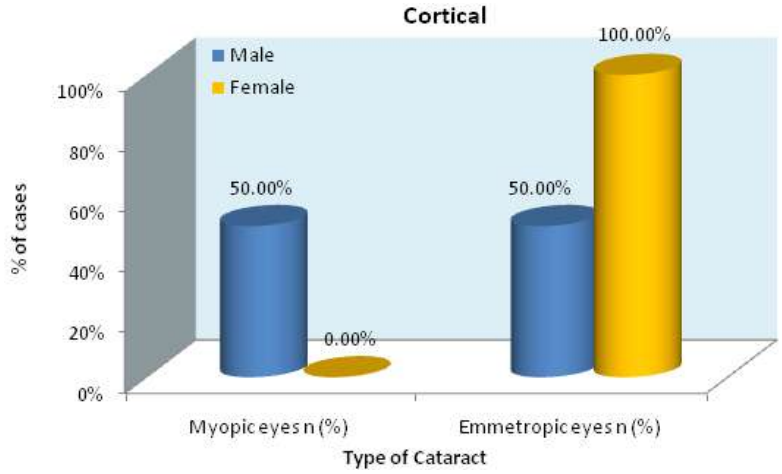
Type of cataract	Myopic Eyes n (%)	Emmetropic Eyes n (%)	Significance
Nuclear	61 (61.00%)	30 (30.00%)	p < 0.001
Cortical	1 (1.00%)	5 (5.00%)	p < 0.001
PSC	6 (6.00%)	14 (14.00%)	p < 0.001
Nuclear + PSC	18 (18.00%)	29 (29.00%)	p = 0.290
Mixed (nuclear + cortical + PSC)	14 (14.00%)	22 (22.00%)	p < 0.001

Table 2 : Distribution of different types of cataracts between emmetropic and genders myopic group.

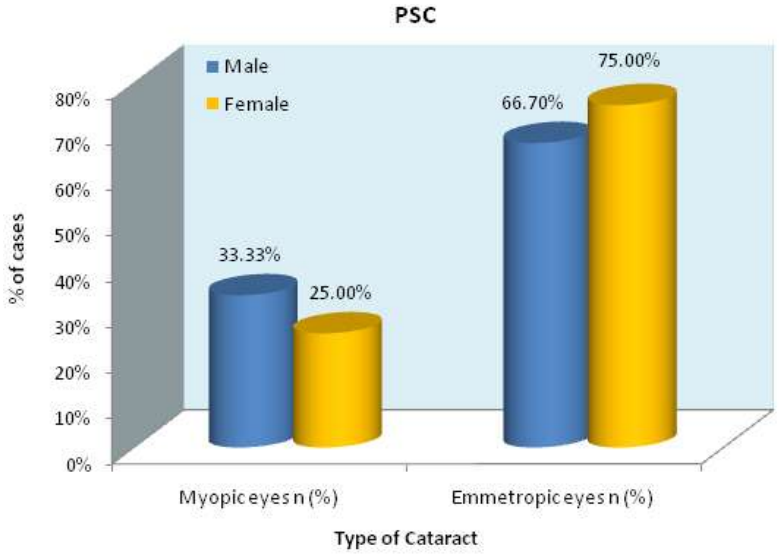
Type of Cataract	Gender	Myopic eyes n (%)	Emmetropic eyes n (%)	Significance
Nuclear	Male	41 (71.9%)	16 (28.1%)	*p* < 0.001
	Female	20 (58.8%)	14 (41.2%)	
Cortical	Male	1 (50.0%)	1 (50.0%)	*p* = 0.051
	Female	0	4 (100%)	
PSC	Male	4 (33.3%)	8 (66.7%)	*p* = 0.698
	Female	2 (25.0%)	6 (75.0%)	
Nuclear + PSC	Male	9 (36.0%)	16 (64.0%)	*p* = 0.698
	Female	9 (40.9%)	13 (59.1%)	
Mixed (nuclear + cortical + PSC)	Male	8 (40.0%)	12 (60.0%)	*P*=0.305
	Female	6 (37.5%)	10 (62.5%)	



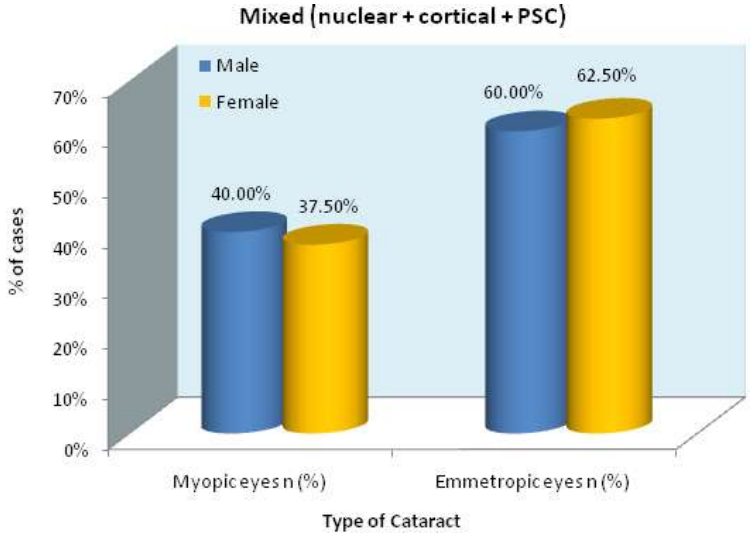
Graph 1: Distribution of different types of cataracts between emmetropic and genders myopic group.



Graph 2: Prevalence of cortical cataracts between genders myopic and emmetropic group.



Graph 3: Prevalence of PSC cataracts between emmetropic and genders myopic group.



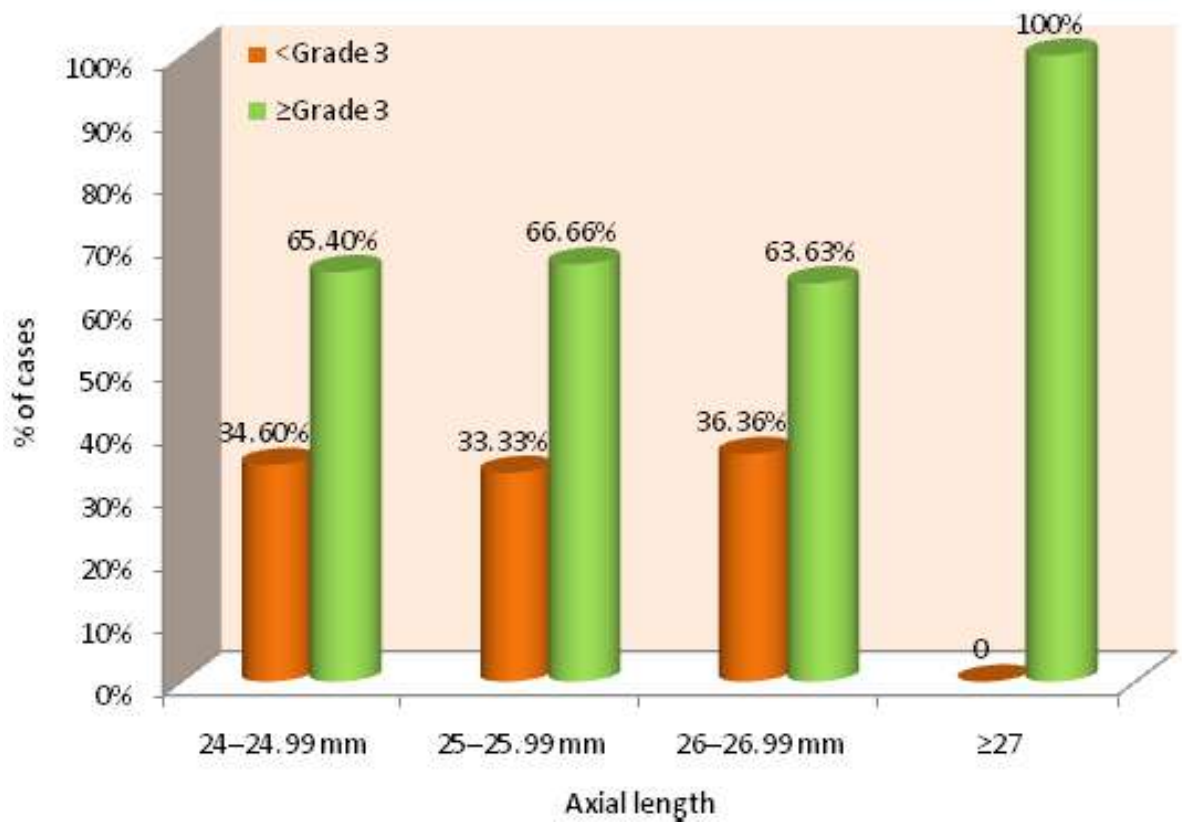
Graph 4: Prevalence of Mixed cataracts between emmetropic and genders myopic group.

Table 3: Distribution of different types of cataracts in myopic and emmetropic group in different age groups.

	40 - 49 yrs of age		50 – 59 yrs of age		60 – 69 yrs of age		≥ 70 yrs of age	
Type of cataract	**Myopia**	**Emmetropia**	**Myopia**	**Emmetropia**	**Myopia**	**Emmetropia**	**Myopia**	**Emmetropia**
Nuclear	11 (61.1)%	3 (16.7%)	24 (64.9%)	11 (33.3%)	18 (62.0%)	10 (29.4%)	8 (50.0%)	6 (40.0%)
Cortical	0	1 (5.5%)	0	1 (3.0%)	0	2 (5.9%)	1 (6.2%)	1 (6.7%)
PSC	4 (22.2%)	8 (44.4%)	1 (2.70%)	4 (12.1%)	1 (3.40%)	2 (5.9%)	0	0
Nuclear + PSC	3 (16.7%)	4 (22.2%)	8 (21.6%)	5 (15.1%)	5 (17.2%)	15 (44.1%)	2 (12.5%)	5 (33.3%)
Mixed (nuclear + cortical + PSC)	0	2(11.1%)	4 (10.8%)	12 (36.4%)	5 (17.2%)	5 (14.7%)	5 (31.3%)	3 (20.0%)

Table 4: Distribution of different types of cataracts in myopic eyes with increase in axial length

Type	**24–24.99 mm**	**25–25.99 mm**	**26.00–26.99 mm**	**≥ 27.00 mm**
Nuclear	34 (59.6%)	17 (62.9%)	4 (57.14%)	6 (66.66%)
Cortical	1 (1.75%)	0	0	0
PSC	4 (7.0%)	1 (3.70%)	1 (14.3%)	0
Nuclear + PSC	10 (17.5%)	5 (18.5%)	1 (14.3%)	2 (22.22%)
Mixed (nuclear + cortical + PSC)	8 (14.0%)	4 (14.8%)	1 (14.3%)	1 (11.11%)



Graph 5: Distribution of different grades of cataracts according to axial length in myopic group

Discussion

A detailed evaluation of the relationship between myopia and the type of cataract were attempted by very few population-based studies. The prevalence between cataract and high myopia has been well established and an association between cataract and simple myopia is suggested. Anecdotal evidence and clinic-based studies have suggested that myopia, particularly severe and pathologic myopia, may increase the risk of cataract. The visual impairment project showed a strong cross-sectional association between nuclear opacity and myopia.

The associations of myopia with the cataract subtypes (cortical, nuclear, and PSC) in the GEE models (Table 1). Compared with myopic eyes and emmetropic eyes were associated with an increased prevalence of nuclear (OR: 3.64, 95% confidence interval [CI]: 3.72–6.69), but not with cortical (OR: 0.58, 95% CI: 0.68–1.08) and PSC (OR: 0.40, 95% CI: 0.56–1.01). As axial length increased (i.e., increasing myopia), there was an increased OR, similar to Armstrong[1] end of nuclear cataract ($p < 0.001$).

Considerable variation exists in published literature regarding what constitutes high myopia. Some authors refer to the refractive error of the eye, while others refer to the power of the implanted IOL. In some studies, an AXL of 25 mm was used to define myopia. In another study [7], myopia was defined as an AXL of 24.5 mm or more. We have defined myopia as an AXL of ≥ 24 mm. Reliable epidemiological population-based data on the prevalence of cataract in reference to AXL is not available in India. In our study, we have described only the prevalence of different types of cataract in relation to AXL. We did not, however, address the issue of the patients' accessibility to cataract surgery.

The majority of the subjects with cataract in our series of high myopia were in the age group of 50–59 years. In another report, a higher incidence of cataract was noted in subjects with myopia in the age group of 50–59 years when compared with other types of refractive error. In the present series, there was a predominance of men in the high myopia group. Similar observations regarding male preponderance were stated in a report on subjects with myopia undergoing cataract surgery. In our present study of the myopia group, we found an association between nuclear cataract and PSC, but none between cortical cataract and PSC. The Beaver Dam Eye [8] Study revealed that when age and gender data were adjusted in patients with myopia who had incurred different types of cataract, myopia was strongly related to nuclear cataract and PSC, but not to cortical cataract.

The association between nuclear cataract and myopia has been demonstrated in several population-based studies among adults of different ethnicities. In our series on myopia, we found a significant association between myopia and nuclear cataract (OR: 3.8, 95% CI 2.9–5.2). The Blue Mountains Eye Study [4,9] made a similar observation (OR: 3.3%; 95% CI 1.5–7.4). In our series of subjects between 40–50 years of age, nuclear sclerosis was predominant. In another study of subjects undergoing cataract surgery, the authors reported a preponderance of nuclear sclerotic cataracts in young subjects with high myopia. Early onset of nuclear sclerosis has been described in another report as well. The relationship between myopia and PSC is controversial. Unlike nuclear cataract, however, PSC does not appreciably effect refraction. Therefore, it has been suggested that this relationship may be causal and myopia may be a risk factor for the development of PSC. While PSC was not associated with high myopia in our series, a relationship between PSC and high myopia has been described in other studies. This premise is supported by findings from the Blue Mountains Eye Study [9] in which myopic refraction and early onset myopia were related to the increased odds for the occurrence of PSC. The Blue Mountains Eye Study[4] supports the premise that long-standing myopia is an independent risk factor for age-related cataract, particularly PSC. In our series, the prevalence of PSC in the myopia group was 6%, while this figure ranged from 24% to 40% in other studies. In our series, no association was observed between cortical cataract and myopia. Similar observations on the association between myopia and cortical cataract have been reported in other studies. In the present study, in subjects less than 49 years of age, the cataract density was higher in eyes with high myopia compared with those eyes with emmetropia. However, we found a statistically significant difference in the cataract density among subjects with myopia and emmetropia; and, as we expected, the occurrence of nuclear cataract was higher with the myopia group. O'Donnell and Maumenee [10] first described cataract as discrete nuclear sclerosis in young subjects with axial myopia and nuclear sclerotic cataract as the cause of unexplained visual loss in subjects with axial myopia. Kaufman [11] and Sugar, in their series on young subjects with high myopia, described the early onset of discrete nuclear sclerotic cataract. To our knowledge, few studies to date have proposed

different mechanisms for cataract formation in the high myopia group.

Our study has important implications. The observations documented in our clinic-based study merit detailed evaluation at the community level to gain an increased understanding of this problem. The relationship between axial myopia and the onset of cataract in young individuals is clearly established. The density of cataract was higher in the myopia group. The strength of our study is that we have defined myopia with an axial measurement rather than with a refractive measurement and also that we have reported the grade of nuclear cataract. We used standardized methods to measure AXL and to establish the density of cataract during data collection. The limitations of this study should also be considered. It was not possible to determine the temporal relationship between AXL and the type or density of cataract because of the cross-sectional nature of the study. Being a clinic-based population study, there may have been a bias during selection. The examiner knew the AXL measurements when observing the type and density of cataract.

Conclusion

Myopic eyes were associated with increased prevalence of nuclear cataract and the density of cataract was also higher in patients with higher axial length. Association was found between axial length and PSCC.

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The second page should carry the full title of the manuscript and an abstract (of no more than 150 words for case reports, brief reports and 250 words for original articles). The abstract should be structured and state the Context (Background), Aims, Settings and Design, Methods and Materials, Statistical analysis used, Results and Conclusions. Below the abstract should provide 3 to 10 keywords.

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State the background of the study and purpose of the study and summarize the rationale for the study or observation.

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Include summary of key findings (primary outcome measures, secondary outcome measures, results as they relate to a prior hypothesis); Strengths and limitations of the study (study question, study design, data collection, analysis and interpretation); Interpretation and implications in the context of the totality of evidence (is there a systematic review to refer to, if not, could one be reasonably done here and now?, What this study adds to the available evidence, effects on patient care and health policy, possible mechanisms)? Controversies raised by this study; and Future research directions (for this particular research collaboration, underlying mechanisms, clinical research). Do not repeat in detail data or other material given in the Introduction or the Results section.

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List references in alphabetical order. Each listed reference should be cited in text (not in alphabetic order), and each text citation should be listed in the References section. Identify references in text, tables, and legends by Arabic numerals in square bracket (e.g. [10]). Please refer to ICMJE Guidelines (http://www.nlm.nih.gov/bsd/uniform_ requirements.html) for more examples.

Standard journal article

[1] Flink H, Tegelberg Å, Thörn M, Lagerlöf F. Effect of oral iron supplementation on unstimulated salivary flow rate: A randomized, double-blind, placebo-controlled trial. J Oral Pathol Med 2006; 35: 540-7.

[2] Twetman S, Axelsson S, Dahlgren H, Holm AK, Källestål C, Lagerlöf F, et al. Caries-preventive effect of fluoride toothpaste: A systematic review. Acta Odontol Scand 2003; 61: 347-55.

Article in supplement or special issue

[3] Fleischer W, Reimer K. Povidone iodine antisepsis. State of the art. Dermatology 1997; 195 Suppl 2: 3-9.

Corporate (collective) author

[4] American Academy of Periodontology. Sonic and ultrasonic scalers in periodontics. J Periodontol 2000; 71: 1792-801.

Unpublished article

[5] Garoushi S, Lassila LV, Tezvergil A, Vallittu PK. Static and fatigue compression test for particulate filler composite resin with fiber-reinforced composite substructure. Dent Mater 2006.

Personal author(s)

[6] Hosmer D, Lemeshow S. Applied logistic regression, 2nd edn. New York: Wiley-Interscience; 2000.

Chapter in book

[7] Nauntofte B, Tenovuo J, Lagerlöf F. Secretion and composition of saliva. In: Fejerskov O,

Kidd EAM, editors. Dental caries: The disease and its clinical management. Oxford: Blackwell Munksgaard; 2003. p. 7-27.

No author given

[8] World Health Organization. Oral health surveys - basic methods, 4th edn. Geneva: World Health Organization; 1997.

Reference from electronic media

[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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