Journal Bangladesh Glaucoma Society

July 2019 Volume 07 Number 02

JBGS

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Journal
Bangladesh Glaucoma Society

Volume - 07 Number - 02 July 2019

Journal
Bangladesh Glaucoma Society (JBGS)

Volume - 07, Number-02, July 2019

Published by :
Dr. Md. Safiul Islam Prodhan
Publication & Publicity Secretary
On behalf of the
Bangladesh Glaucoma Society
House # 12A, Road # 05, Dhanmondi, Dhaka
email : bangladeshglaucomasociety@gmail.com
website : www.bgsbd.net

Printed at :
New Ekata Computer & Printers
435/A-2, Baro Moghbazar, Dhaka-1217
Tel : 01715444644

Courtesy : ARISTOVISION

Bangladesh Glaucoma Society

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Glaucoma drainage devices taking a growing role in the treatment of refractory Glaucoma

M N Islam[1]

Glaucoma drainage devices (GDD) or Tubes are designed todrain aqueous humour from the anterior chamber to an external reservoir. A fibrous capsule forms within 4-6 weeks after surgery and regulates the flow. These devices have shown better success in controlling intraocular pressure (IOP) inthe eyes with previously failed trabeculectomy and in eyes with scarred conjunctiva from prior surgical procedures or injuries. They also have demonstrated success in complicated glaucoma, such as Neovascular glaucoma, Inflammatory glaucoma[1].

Since the introduction of the first glaucoma drainage device, Molteno implant[2], various modifications of the original design and improvements in surgical techniques over the past 40 years have led to greater success and lower the complication rates. In addition, other glaucoma drainage devices have been introduced and offer unique features designed to facilitate implantation, improve IOP control, and reduce acute postoperative hypotony.

Currently, different variety of glaucoma drainage devices are available. They are in different sizes, materials, and design with the presence or absence of an IOP regulating valve. The nonvalved devices include the Molteno, Baerveldt,Paul Glaucoma Implant (PGI)[3]. Unlike the nonvalved devices, the valved or flow-restrictive devices allow only unidirectional flow from the anterior chamber to the subconjunctival space with a minimum opening pressure. The most commonly used valved implant is the Ahmad glaucoma valve (AGV).

The growing evidence that glaucoma drainage devices provide some advantages over more widely used surgical treatments for advanced glaucoma has led more surgeons to consider expanding their use of devices/ tube shunts. Surgeons in Bangladesh also report that their use of some drainage devices has increased in recent years.

Most glaucoma implants are placed in a single quadrant. Whenever possible, single-plate implants should be placed in the supero-temporal quadrant. This area provides the easiest access for the surgeon to implant the plate and is least likely to produce motility disturbances. Implantation of a large plate aqueous shunt in the supero-nasal quadrant has been associated with Brown's superior oblique tendon syndrome[4]. Substantial hypertropia and limitations of down gaze has been reported with inferior implantation of two-plate Molteno and the Krupin valve with disc[5]. In eyes containing silicone oil, the implant is placed in the inferior quadrant to minimize loss of oil, which is lighter than aqueous and floats up.

The clear advantage of devices, such as the Baerveldt implant was highlighted in a Tube Versus Trabeculectomy (TVT) study—published in the American Journal of Ophthalmology in September 2006, that compared outcomes and complications between patients randomized to receive either that device or a trabeculectomy. The five-year study enrolled patients from 1999 to 2003, included 212 patients between ages 18 and 85, who had an IOP between 18 mm Hg and 40 mm Hg, and who had either previous trabeculectomy, cataract removal with IOL implantation, or both.

Wilson et al.compared short and intermediate results of trabeculectomy and AGV in a randomized clinical trial and reported statistically lower mean IOP with trabeculectomy than with AGV at weeks 6-15 and months 11-13. The cumulative probability of success was 83.6% for the trabeculectomy group and 88.1% for the AGV ($p=0.43$). There was no significant difference in complication rates between the two groups, but the AGV group required more glaucoma medications postoperatively. The same investigators subsequently reported the long-term results of these two procedures. The cumulative probabilities of success at months 41-52 were 68.1% for the trabeculectomy group and 69.8% for the AGV group ($p = 0.86$). Adjunctive medication requirement was also comparable in both groups with longer follow-up[6].

Gedde et alhave been investigating the clinical

outcomes of nonvalved tube shunt, specifically the Baerveldt 350 mm^2, and standard trabeculectomy with mitomycin C in a multicenter, randomized clinical trial. A total of 212 eyes were enrolled with IOP 18 mm Hg and 40 mm Hg. The main outcome measures were IOP, visual acuity, and reoperation for glaucoma. At 1 year follow-up, IOP control was good in both groups, with slightly lower pressures in the Baerveldt group. The mean IOP was 12.7± 3.9 mm Hg in the trabeculectomy group and 12.4± 3.9 mm Hg in the Baerveldt group (P=0.73). The cumulative probability of failure during the first year was 3.9% in the Baerveldt group and 13.5% in the trabeculectomy group (p=0.17). Intraoperative complications occurred in 7% of the Baerveldt group and 10% of the trabeculectomy group (P=.59). Postoperative complications were more common in the trabeculectomy group than in the Baerveldt group, 57% versus 34%, respectively. Adjunctive glaucoma medications were required more in the Baerveldt group. Longer follow-up of this study will elucidate further details on IOP control and other common in cases of inferior implant placement. This imbalance usually results from a mass effect of the plate and the surrounding bleb on adjacent extraocular muscles. Other possible causes include Faden or posterior fixation suture effect induced by scarring under the rectus muscles, entrapment of superior oblique muscle or fat fibrosis syndrome because of inadvertent manipulation of orbital fat, or a pseudo-Brown's syndrome from supero-nasal insertion of drainage devices. Diplopia secondary to drainage devices is difficult to treat and various treatment options include prisms, muscle surgery, or even removal of the drainage implant [7].

In this issue of JBGS different articles published on the success of GDD. Z. Hassan, BK Sarkar et all in their review article "Ahmed Glaucoma Valve Implantation in Primary Angle Closure Glaucoma (PACG) following Bilateral Combined Surgery – A Case Report" concluded that though the use of AGV for controlling refractory glaucoma is well known but its use in PACG is scanty. By the report authorsconcluded that implanting AGV is viable option for controlling IOP up to three years in PACG with failed combined surgery.

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Another case report of MZ Hassan, J Kabir et al, showed a complication of Choroidal Effusion with Exudative Retinal Detachment Following of AGV in a case of Sturge Weber Syndrome. They suggested as Ahmed glaucoma valve offers safety and efficacy in controlling glaucoma in pediatric Sturge- Weber syndrome with choroidal hemangioma. However surgeons should anticipate and prevent sudden hypotony otherwise this complication can occur in many cases[8].

Another article by MN Islam on New Technique - Ahmad Glaucoma Valve and Paul Glaucoma Implant in PACG also described detail of surgical procedure in angle closure glaucoma. PGI is a non valved implant with narrower tube has distinct advantage over other larger tubes in the ACG as it takes little space in the anterior chamber. So this tube can keep larger space between cornea and iris.

Therefore we hope, the use of GDD will be more among the Glaucoma specialists in Bangladesh and refractory glaucoma eyes could be saved in many patients. We expect that our government policy would be patient friendly and allow to import these devices from abroad without taxes so that ophthalmologists can do the surgery in low cost and glaucoma patient can be benefitted.

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Prevalence of Primary open angle glaucoma (POAG) in patients with newly detected diabetes

A K M M Hoque[1]

Abstract:

Purpose: To assess the prevalence of primary open angle glaucoma (POAG) among the new detected diabetes patients.

Methods: The cross sectional study was carried out in a tertiary hospital in Bangladesh during the period of 01 January 2015 to 31 December 2018. We evaluated newly detected diabetic patients irrespective age and gender. Known case of diabetes and primary open angle glaucoma were excluded in this study.

Results: Total 17282 patients were found as newly detected diabetes, 662 patients (3.83%) were diagnosed as primary open angle glaucoma among the study subjects. 485 patients (73.3%) showed their IOP more than 20 mm of Hg. Central corneal thickness was found less than 500mm in 655 patients 98.9%. Tubular vision was found in 9 patients (1.33%). Cup-disc ratio was more than 0.5 in 390 patients (59%).

Conclusion: In conclusion strong evidence in support of significant positive association between diabetes and POAG. The study highlights the prevalence and demographic characteristics of glaucoma among diabetes mellitus patients in a tertiary care hospital in BIRDEM. Hence this study would document the prevalence of glaucoma in diabetes mellitus patients in Bangladesh. Where no such study has been done before and play and integral role in raising awareness amongst the people.

Keywords: Diabetes, Open angle, Glaucoma, Age

Introduction

Diabetes mellitus is a syndrome of impaired carbohydrate, fat and protein metabolism caused either due to the lack of insulin secretion or decreased sensitivity of the tissues to insulin.

World Health Organisation (WHO) has declared that the incidence of diabetes is increasing rapidly world-wide which has become a major public health concern. Global prevalence of diabetes was estimated to be 2.8% in 2000 and is predicted to be 4.4% in 2030.

The incidence of diabetes mellitus is increasing in an alarming rate and of which glaucoma diagnosis is often ignored among the diabetic population. Till date there has been no published report on the proportion of diabetic patients suffering from glaucoma.

Glaucoma is a group of ocular disorders characterised by damaged to the optic nerve. In its early stages, it may present with few or no symptoms but can gradually steal sight without warning due to increased intra ocular pressure the drainage system gets blocked and the fluid cannot exit at a normal rate, thus leading to blindness if not treated timely. The increased pressure pushes against the optic nerve which may result in vision loss usually starting with peripheral or side vision.

Drainage of aqueous humour gets obstructed which causes increased intra ocular pressure. It may be: 1) Congenital – due to developmental anomalies 2) Secondary – due to complications of other diseases 3) Primary – (a) Open angle (b) Angle closure.

Uncontrolled Type 1 diabetes mellitus or type 2 diabetes mellitus for a long enough period will lead to the development of diabetic retinopathy, which then triggers new blood vessel formation in the ocular anterior segment and interferes with the normal internal drainage of the eye leading to glaucoma. There is considerable evidence that T2 diabetes mellitus is a risk factor for primary open angle glaucoma.

Glaucoma is a gradually advancing optic neuropathy which may lead to permanent

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blindness affecting 66.8 million people worldwide in year 2000. In India, prevalence of glaucoma range from 4.96% to 14.6%. The World Health Organization (WHO) has reported glaucoma as important eye disease affecting 66.8% million people throughout the world whose treatment has to be done as soon as possible. According to vision 2020 initiative, glaucoma is significantly contributing to global blindness percentage. The risk has been reported to be 1.6-4.7 times higher in individuals with diabetes than in non diabetic individuals.

Objectives:

1. To study the proportion of glaucoma in diabetes mellitus patients.

2. To study the demographic characteristics (age group, gender) in patients having glaucoma.

Materials and Methods:

Study design: This was a hospital based cross-sectional study conducted in the department of Ophthalmology in BIRDEM General Hospital, Dhaka.

Study Population: 17282 diabetic patients visiting the Eye opd were taken.

Study Duration: The study was carried out for 4 years 1st January 2015 to 31st December 2018.

A total of 17282patients with diabetes mellitus (DM) attending the eye out patients department (OPD) were selected with approval from the Institutional Ethics Committee (IEC).

Fasting and post prandial blood sugar level were recorded for the confirmation of diabetes mellitus along with the clinical history.

Patients blood pressure was measured and recorded.

Detailed Questionnaire was prepared for the patients and written informed consent was obtained from each patients prior to the study. The questionnaire included questions regarding age, sex, family history and the knowledge of diabetes and glaucoma.

InclusionCriteria: Patients with 18 years of age and above diagnosed with diabetes mellitus, following the standard diagnostic criteria recommended by American Diabetic Association.

Exclusion Criteria: Any active eye diseases like conjunctivitis, iridocyclitis.

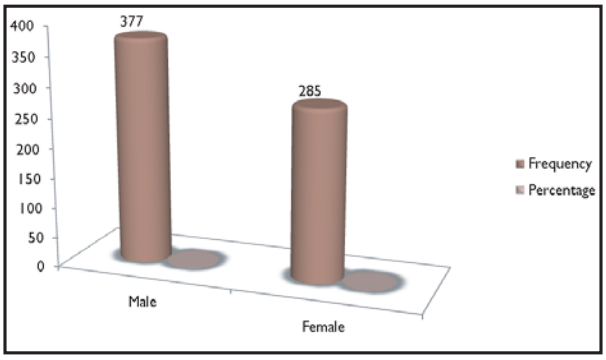
A comprehensive eye examination was done by an ophthalmologist including measurement of IOP by applanation tonometry, evaluating the drainage angle of the eye by doing gonioscopy. The optic disc examination by direct ophthalmoscopy, 78D Valk lens and OCT- Optic discs and RFNL analysis and a visual field analysis byperimetry, CCT measurmentwas done for each patient.

Result

A total of 17282 diabetic patient participated in the study out of that 662 patients were had glaucoma. Among the 377 (57%) were male and 285 (43%) were female. The mean age was 48.5± 10.4.

Table 1: distribution of male and female in the study population(n=662)

Sex	Frequency	Percentage
Male	377	57%
Female	285	43%

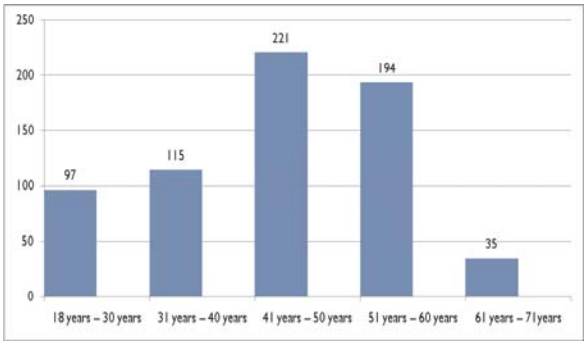


57% of the study populations were males and 43% were females

Age group of the study population (n=662)

Among the glaucoma patients 41 to 50 years were found to be more common.

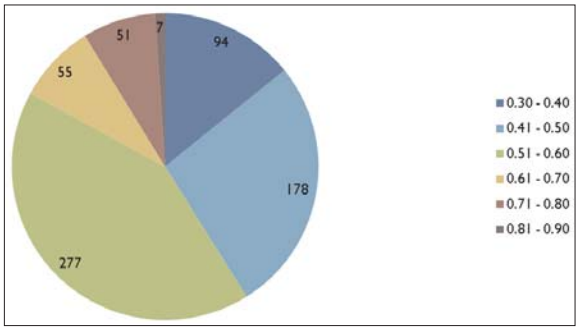
18 years – 30 years	97	14.65%
31 years – 40 years	115	17.37%
41 years – 50 years	221	33.38%
51 years – 60 years	194	29.30%
61 years – 71years	35	5.28%



CD ratio

Among the cup disk ratio, 0.51 to 0.60 that is 277 (41.48%) are more common.

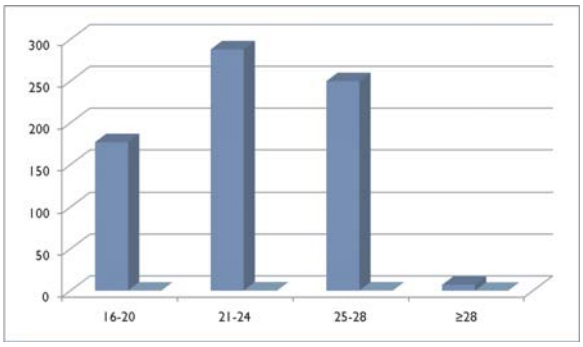
0.30 - 0.40	94	14.19%
0.41 - 0.50	178	26.88%
0.51 - 0.60	277	41.84%
0.61 - 0.70	55	8.30%
0.71 - 0.80	51	7.70%
0.81 - 0.90	7	1.05%



10P mm of Hg

In the distribution of IOP 21 to 24 mm of Hg was found in 288(34.44%) were more common.

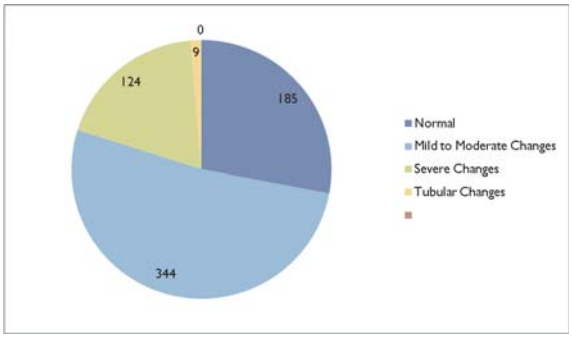
16-20	177	26.30%
21-24	288	34.44%
25-28	250	37.76%
>28	7	1.05%



VAF Changes

Visual Field Analysis changes showed mild to moderate changes in 344 (51.96%) patients which is more common and in first detected visual field analysis. And tubular field of vision in only 9(1.35%).

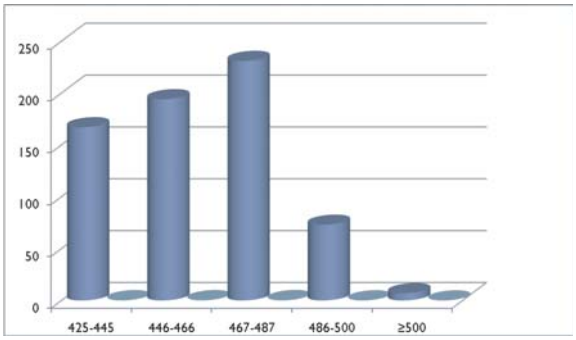
Normal	185	27.49%
Mild to Moderate Changes	344	51.96%
Severe Changes	124	80.73%
Tubular Changes	9	1.35%



CCT

Among the central corneal thickness, less than 500 µm is found to be much higher 665 (98.94%).

425-445	167	23.71%
446-466	194	29.30%
467-487	231	34.89%
486-500	73	11.02%
>500	7	1.05%



Discussion

Our study showed that among 17282 diabetic patients attending in the ophthalmology department of BIRDEM General Hospital, 3.83% had glaucoma. Many of the diabetic patients had visited the eye OPD for routine examination to get the fundus checked for diabetic retinopathy. The mean age of our subject was 48.5±10.40 which is quite similar to the results in the research done by sheetal. Dharmandhikari etal where the mean age was 53.8±10.7 years. The prevalence of glaucoma was found to be 15.6% where as in our study the prevalence was found to be 3.83% which is very much less in our study. In other study done in north east of India, the prevalence was found only to be 8.25% which is a bit closer to our study.

Backer et al had found that 26% of the POAG patients has a positive family history of glaucoma but in our study none of the patient reported a positive family history, according to the Beena R et al, primary open angle glaucoma was found to be the most common type of glaucoma with a prevalence of 5.8%, similarly in our study all the glaucoma patient had primary open angle glaucoma.

Diabetes mellitus had been proposed as a risk factor for POAG, but epidemiologic studies on the association between diabetes and glaucoma were still controversial. Although some glaucoma, some others believed that the higher prevalence of glaucoma in individuals with diabetes was caused by the more frequent ophthalmologic visits among diabetes patients.

The mechanisms relating diabetes links between diabetes mellitus and glaucoma had been proposed. First, it was postulated that diabetes would lead to impairment of vascular auto regulation. These vascular injuries would reduce blood flow to the retina and optic nerve, resulting in reduced nutrient and oxygen supply to the RGC axons and increased expression of hypoxia- inducible factor – in the retinal cells in response to elevated LOP. Ultimately these were likely to induce the degeneration of the RGCs and initiation of glaucomatous impairment. Second, there was a large amount of evidence that the hyperglycemia and lipid anomalies induced by diabetes could increase the risk of neuronal injury, indicating that the RGCs were more likely to be killed in the patients with diabetes. Third, the hyperglycemia of aqueous humor in the eyes of diabetes patients would stimulate the synthesis and accumulation of fibronectin in the trabecular meshwork to promote depletion of trabecular meshwork cells, which could impair the outflow system of the aqueous humor and finally result in POAG.

Conclusion

In conclusion strong evidence in support of significant positive association between diabetes and POAG. The study highlights the prevalence and demographic characteristics of glaucoma among diabetes mellitus patients in a tertiary care hospital in BIRDEM. Hence this study would document the prevalence of glaucoma in diabetes mellitus patients in Bangladesh. Where no such study has been done before and play and integral role in raising awareness amongst the people.

Review of Literature

According to Dharmadhikari et al the mean age was 53.8 ± 10.7 years. There were 320 (38%) females. The prevalence of glaucoma was 15.6% (95% CI: 13-1-18-1), 42.4% were pure vegetarians.

According to Thakuria Jayantin et al them age of glaucoma patients was 53.50 years, hereditary preponderance was found in 23.81% patients and POAG was found in 8.25%, 32 out of 388 diabetes. POAG was diagnosed in 84 diabetic patients (7.0%) in the age group of 15-75 years.

Becker et al. had found that 26% of the POAG patients had a positive family history of glaucoma. According to Beena R et al. Primary open angle glaucoma was found to be the most common type of glaucoma with a prevalence of 5.8%

According to Lingam Vijaya et al .the mean age was 53.78± 10.71 years, and 55.1% were women. Data also suggests that the prevalence of POAG varies from race to race with a significant increase in prevalence with age, but there was no difference in age-adjusted specific rates between genders.

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Original Article

Distribution of Intra-Ocular Pressure (IOP) in a Bangladeshi adult population measured by Non Contact Tonometry (NCT)

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Abstract

Background : Elevated intra-Ocular Pressure (IOP) is the most common risk factor for glaucoma [1-2]. So tonometry is essential for both diagnosis and management of blinding disease glaucoma. The distribution of IOP within general population has the range of 11-21 mmHg (mean 16 mmHg). But these values are based on studies done on western population. No reference values until now are available from study done on Bangladeshi people. The aim of this study is to provide the range of IOP values of our population for better understanding of glaucoma prevailing in Bangladesh.

Objective : To evaluate the normal range of IOP values in a Bangladeshi adult population.

Subjects, Methods & Materials : In this cross sectional observational study was conducted over of total 115 cases with age ranged of 20-65 years old and 230 eyes were randomly selected in Outdoor Patient Department (OPD) of Ashiyan Medical College Hospital, Khilkhet, Dhaka, in the period of May 2916 to December 2016. All participants had optometric and ophthalmic examinations. IOP was determined by using Non contact tonometer of NIDEK-NT-510 model. IOP measured with NCT was the mean of three consecutive measurements.

Results : Of the 115 people selected for the study, mean age of the participants was 31.5± 6.27yrs and 50.43% of them were female and 49.57% were male. Mean IOP was 14.85± 0.84 mmHg of male and 15.30±0.80 mmHg of female respectively. There was no significant difference ($p > .05$).In this study 0.8695% of the participants had an IOP higher than 21mm Hg, but their optic discs and visual fields were normal.

Conclusion : This study revealed that the IOP is not concomitant with western values, which are a bit higher.

Key words : Intra-Ocular Pressure (IOP), Tonometry, Glaucoma, Central Corneal Thickness (CCT), Pulsair Non-Contact Tonometer (PNCT), (Goldman Applanation Tonometer) GAT

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Introduction

Elevated intraocular pressure IOP is the most common risk factor of glaucoma[1]. Glaucoma is a blinding disease if remains undiagnosed and untreated. Normal range of IOP in Western people is 10-21 mmHg (Mean 16 mmHg). But glaucoma with normal range of IOP is also not uncommon, especially in Bangladesh. Unlike systemic hypertension just measurement of IOP is not enough for diagnosis of glaucoma. Other criteria are visual field analysis and optic nerve head (ONH) evaluation. In glaucoma management, percentage reduction in IOP is one of the important indices for different treatment protocols[4-7]. But in present situation in Bangladesh we always use reference values based on Western population study. But there is a chance of differences of IOP values of our population as evidenced from other studies conducted in other countries in Asia[13,16,23,24,33,51]. To know the normal range of IOP is quite vital for diagnosis and proper management of glaucoma. Many systemic, ocular and even biometric indices may be correlated with IOP[8-15]. One of these important ocular indices is the Central Corneal Thickness (CCT) which can impact IOP readings. Therefore, IOP distribution can differ in different countries in relation to the distribution of CCT[16-22]. On the other hand, other factors such as systemic blood pressure can influence IOP[23]. Other risk factors include age, sex, alcohol consumption, smoking and family history of elevated IOP reported to affect distribution of IOP[8-13,16,24-28].

In the light of the diversity of risk factors, many studies around the world have focused on the distribution of IOP[8-14,16,24,25]. According to these studies, mean IOP is higher in Northern

American and European countries compared to East Asian countries[8-16,24,25,29]. Knowledge of IOP distribution in different regions is essential because in epidemiologic studies, one of the diagnostic criteria for glaucoma is an IOP higher than the 99.5th percentile of the population[1]. Due to ethnic and racial variations in IOP distribution, study findings of one population cannot be generalized to other populations. Even age related IOP variations seem to differ among races[8-14,16,24,25,30], just as diurnal IOP fluctuation of an individual can vary[31,32]. In an Iranian study showed that, Iranian population has lower IOP levels compared to European countries[13]. More evidence around/about IOP distribution is needed to confirm findings regarding Bangladeshi population. This study was designed to describe the distribution of IOP in an 20-65 yrs old sample population of Dhaka, capital of Bangladesh.

There are different methods of IOP measurement from manual Shiotz indentation tonometry, Goldman applanation tonometry to Non-Contact air puff tonometry. There is slight difference of IOP values measured by different methods in same subject. The present study was carried out to find out range of IOP values in non glaucomatous people in Bangladesh.

Non-Contact tonometry is an ideal method for mass screening than GAT for many reasons. In some study it showed that PNCT under estimated IOP in contrast to GAT in the range of -1.52 to -0.82 mmHg. That means it is very approximately similar to IOPs measured with GAT[3].

Subjects, methods and materials :

This cross-sectional observational study done in 2016 and 2017 of 115 patients' 230 eyes were randomly selected for measurement of IOP. The target population was 20-65 years old both male and female inhabitants of Dhaka city and around. Specific excluding/including criteria were followed. IOP measurements were done from 9:00 AM to 12:00 Noon. All the measurements were done by the same skilled operator with same PNCT machine. Refractive status of patients were assessed along with ocular examinations necessary were done by slit lamp and Ophthalmoscope to detect exclusive criteria. Central Corneal Thickness measurement was not included in this study. Mean IOP of three readings of each eye was automatically recorded by the computerized system of the PNCT.

Exclusion Criteria

1. Diagnosed glaucoma patients
2. High refractive error
3. Any sclero-corneal pathology and surgical or non surgical trauma
4. Extreme ages
5. Retinal detachments
6. Diabetic, hypertensive, COPD, obese patients
7. Steroid user and responder
8. Uveitis patients
9. Cataract patients
10. Non co-operative patients with blinking and blepharospasm
11. Narrow anterior chamber angle assessed by Van Herick test

Inclusion Criteria

1. Phakic- non cataractous eyes
2. Calm and quiet eyes without any signs or symptoms of inflammation and allergies
3. To avoid diurnal fluctuation recording time was 9:00 am to 12:00 noon
4. Normal anterior chamber angle

Results

In this study 115 respondents were enrolled. IOP was measured in their 230 eyes. The ranged age of the participants was 20-65 yrs and 50.43% were female and 49.57% male. Age and sex distribution are presented in Table 1. Mean age for male were 31.5 ±6.27 yrs and for female were 29.8 ± 10.9 yrs. The major proportion of respondents belonged to age group 20-30 yrs According to the findings of this study, the mean IOP was 14.6 ±0.96 mmHg. Study revealed that IOP of Bangladeshi adults were normally distributed. Mean IOP by age and sex are presented in Table 2. After adjusting for age mean IOP was not increased with age.

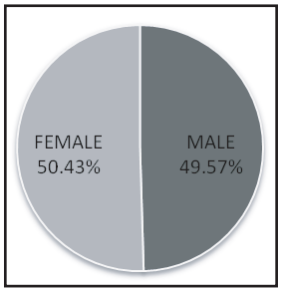

Figure 1: Distribution of Bangladeshi responders by sex

Table 1: Distribution of Bangladeshi responders by age and sex

Age groups	Male (n=57)		Female (n=58)		Total (n=115)	
	No.	% of distribution	No.	% of distribution	No.	% of distribution
<20 yrs (n = 7)	04	07.02	03	05.17	07	06.10
20-30 yrs (n=69)	30	52.63	39	67.24	69	60.00
31-40 yrs (n=17)	12	21.05	05	08.62	17	14.77
41-50 yrs (n=13)	06	10.53	07	12.07	13	11.30
51-60 yrs (n=7)	03	05.26	04	06.90	07	06.10
>60 yrs (n=2)	02	03.51	00	00	02	01.73
Total	**57**	**49.57**	**58**	**50.43**	**115**	**100**

Regarding gender distribution of patients, female (50.43%) outnumbered male (49.57%). Age group 20-30 yrs gripped major proportion (60%) of participants. Among them 49.48% was male and 50.52% female. The second highest percentage (14.77%) belonged to the age group 31-40 yrs. Only 01.73% was in the age group above 60 yrs of age. The mean age of male was 31.5±10.8 yrs and female was 29.8±10.9 yrs.

Table 2: Distribution of Mean IOP (mmHg) by age and sex

Age group	Male	Female	Total
<20 yrs (n=7)	15.78	15.45	15.615
20-30 yrs (n=69)	15.28	15.33	15.305
31-40 yrs (n=17)	14.89	13.28	14.085
41-50 yrs (n=13)	13.75	15.64	14.695
51-60 yrs (n=7)	12.31	16.85	14.58
>60 yrs (n=2)	13.7	00	13.7
Average	**14.85±0.84**	**15.3±-0.80**	**14.6±0.96**

The mean IOP of male and female were 14.85±0.84 mmHg and 15.30±0.80 mmHg respectively. It revealed that the highest mean intra ocular pressure (IOP) of male was 15.78 mmHg in the age group of <20 yrs, followed by 15.28 mmHg in the 20-30 yrs. On the contrary, in female, the highest mean IOP was 16.85 mmHg in the age group 51-60 yrs, followed by 15.64 mmHg in 41-50 yrs.

Table 3: Results of other studies concerning IOP[50]

Authors	Country	Age group (a)	X ± s
Tomoyose et al	Japan	40	15.1±3.1
Wong et al	Korea	40-99	13.5±2.7
Foster et al	British	48-91	16.0±3.68
Zheng et al	China	8-16	14.2±2.3
Leske et al	USA	40-84	Black: 18.7±5.2
			Mixed: 18.2±3.8
			White: 16.5±3.0
Hoegn et al	Germany	35-74	14.0±2.6
Salakar et al	Turkey	5-18	14.15±2.8
Landers et al	Australia	20	12.8±3.2
Hashemi et al	Iran	40-64	12.87±2.27
Fiuffre et al	Italy	31-40	15.1±3.7

Discussion

In this report, it was presented a study of IOP distribution in 20-65 yrs old Bangladeshi population. The weak points of the study include its small sample size, IOP measurement only once ignoring intra individual measurement error that may occur as a result of diurnal fluctuations. Ocular biometrics like Central Corneal Thickness (CCT), axial length of eye balls, anterior chamber depth and refractive error were not included.

Mean IOP in the present study was 14.6 ± 0.96 mmHg as demonstrated; the histogram was skewed towards higher results. Results of other studies are presented in Table 3. As demonstrated in this table, mean IOP shows a wide range from 12.8 to 18.7 mmHg in population based studies. This wide range is partly due to the age structure of the studies. IOP in this study was lower than almost all other studies except Hashemi et al study. This finding may be difficult to explain. One reason could be the variety of IOP measurement devices. In addition, since IOP correlates with many factors

such as biometrics, family history of glaucoma, age, sex etc[8-13,16,24-28] and different distribution of these factors in different geographic areas can be another reason for the observed differences in IOP distribution. For example, BMI correlates directly with IOP[34,35]. This index is relatively high in European countries and low in East Asian countries. As for IOP, again we see higher averages in European people and lower in East Asian people.

As demonstrated, IOP distribution was skewed to the right. A similar observation was in some other studies[13,36,37]. Since younger people have IOP in the normal range, distribution skewness is not respected in these groups. But since especially open angle glaucoma increases with age, it is not unexpected to see a higher IOP which is the major risk factor[38]. Thus, the distribution being skewed to the right in this group is due to the high IOP in some people.

In this study, the IOP was higher than 21 mmHg in 0.87% of the studied population; other studies have reported higher percentage. Since the average IOP in this study was lower than other studies (Table 6), the cutoff point must be determined based on percentile calculated from this study. The IOP was higher in females in this study. Results of other studies regarding IOP and gender are inconclusive.

In agreement with our results, studies in Korea have reported higher IOP in women[9]. On the contrary, IOP was higher in men in studies in Italy[30] and Barbados[25]. The relationship between age and IOP has been reported differently in previous studies. In this study, IOP decreases with age except 41-60 yrs female groups where it is increased. In Tehran[13], Italy[30], BeaverDam[52], Barbados[25] and Frahingham studies IOP increased with age, while results in East Asian countries like Japan[53-57], South Korea[58] IOP decreased with age. In another Asia population Wang et al found that IOP increased to the age of 60 yrs and decreased thereafter. In China study, IOP increased up to the age of 64 yrs and decreased thereafter[40].

The study on the population of Karachi found an age related increase in IOP until age 60 yrs, a plateau between 60 to 70 yrs of age, followed by IOP increase thereafter[41]. In the Blue Mountain Eye study[27], IOP increased with age but the relationship was reversed after adjusting for systemic blood pressure and eventually after adjusting for diabetes, family history of glaucoma and myopia, the model revealed there was correlation between IOP and age. The relationship between age and IOP seems to be affected by other age-related risk factors such as blood pressure, diabetes and even obesity, but we include them as exclusive criteria.

In this study, we did not adjust IOP for axial length, CCT and other variables. So this is a limitation of our study. A higher IOP in myopic has been observed in previous studies[40-42,43-46] and myopia has been reported as a glaucoma risk factor[46-49].

The result of the study was concomitant to the study of Zheng et al[8], Hoehn et al and Sakalar et al[16].

Conclusion

Mean IOP in the 20-65 yrs old population in Bangladesh was lower than average reported in most other studies. This is of special importance in the diagnosis of glaucoma in Bangladeshi population and further evaluations in a large sample of this population are needed to define cut off points for identifying cases at risk of glaucoma. This is also important to decide target pressure for initiating medical management of freshly diagnosed glaucoma. As observed in other studies DM, Refractive errors, HTN like risk factors should be noted in patient's checkups and in indentifying cases at risk of glaucoma.But we have not included in our study.

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Evaluation and comparison of retinal nerve fibre layer and optic nerve head parameters for screening, early detection and to assess glaucoma progression measured by cirrus HD-optical coherence tomography

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Abstract:

Purpose : The purpose of the study was to evaluate and compare the ability of RNFL thickness and ONH parameters measured by Cirrus HD-OCT to differentiate between normal, primary and progressive glaucomatous eye.

Methods : A retrospective cross sectional study conducted on 185 eyes of 185 patients who were selected randomly. Among them 74 patients selected for screening group, 44 for glaucoma suspect groupand 67 patients for disease progression group. All subjects underwent a complete ophthalmic examination and optical coherence tomography done by Cirrus HD-OCT 400. Statistical analysis was performed using SPSS software version 23. Analysis of variance (ANOVA), ROC curve was done to measure AUCs to understand the parameter's discriminating power.

Results : Mean of retinal nerve fibre layer thickness is 85.76 ± 23.29 μm in glaucoma screening group. The thickness is gradually observed less in glaucoma suspect and glaucoma progress group which are 74.55 ± 14.66 μm and 64.39 ± 15.26 μm respectively. The most affected quadrant in glaucoma screening group is inferior quadrant. Among the ONH parameters, rim area showed highest value 1.28mm^2 in glaucoma screening group. The disc area, average cup disc ratio, vertical cup disc ratio and cup volume show lowest value in glaucoma screening group when compared with glaucoma suspect and glaucoma progress group which are gradually higher ($p < 0.05$).

Conclusion:The results of the study indicate that both RNFL and ONH parameters measured by Cirrus HD-OCT are useful for screening, early detection and to assess glaucoma progression by differentiating between normal and glaucomatous eye.

Keywords : Cirrus HD-OCT, RNFL thickness, ONH, Glaucoma screening

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Introduction

Glaucoma is considered as the second most common cause of blindness in the whole world. It is a chronic, multifactorial and degenerative optic neuropathy which is characterized by progressive loss of retinal ganglion cells and their axons[1]. This progressive neurodegeneration causes retinal nerve fibre layer attenuation along with specific patterned damage of optic nerve head that can cause irreversible loss of vision[2]. Glaucoma is a slowly progressing disease, which make it's identification often challenging. Moreover, it is often difficult to differentiate between true disease related changes and natural age related changes[3]. Because of its variable time course some patients show structural changes in retinal nerve fibre layer and optic nerve head before appearance of detectable glaucomatous symptoms[3]. Early detection ismost essential for clinical management of glaucoma and vision preservation. Optical coherence topography is a powerful and high resolution glaucoma imaging device that can describe glaucoma both qualitatively and quantitativelyby targeting optic disc and macular area with high sensitivity and specificity[4]. Glaucoma presents with neuro retinal rim thinning, notching, cupping, high cup disc ratio, retinal nerve fibre layer defect and excavation of optic nerve head[1]. Ocular coherence tomography has become a tool of choice for clinical evaluation of the optic nerve

and the retina. The Cirrus HD-OCT measures the RFNL thickness and evaluates the OHD by using the property of coherence tomography[5]. This advanced technology provides an objective and quantitative measurement of RFNL and OHD by measuring the echo time delay and intensity of backscattered light from different retinal layers[6].

Purpose

It is expected that, Cirrus HD-OCT has superior performancefor detecting the early stage of glaucoma by itsspecificity and reproducibility[5,7]. Although the use of multiple parameters could increase the chance of false positive result or there might be some partial structural damage but it is important to have information from ONH and RNFL in glaucoma diagnosis[8]. The purpose of the study was to evaluate and compare the ability of RNFL thickness and ONH parameters measured by Cirrus HD-OCT to differentiate between normal and progressive glaucomatous eye.

Glaucoma screening

Glaucoma is usually asymptomatic till it`s late disease process. If detected earlier it is possible to slowdown or prevents the progression of vision loss by adequate treatment[9]. So, glaucoma screening tool for general population is highly desirable. It is more effective and beneficial for high risk people like older patient with positive family history of glaucoma. Cirrus HD OCT is highly sensitive for early detection in a high risk population[10]. Identification of early glaucomatous structural damage in terms of structural remodeling of ONH is essential for early diagnosis, management and prevention of vision loss[11].

Glaucoma diagnosis

The use of OCT for glaucoma diagnosis has become a common clinical practice now a day. The RNFL and ONH parameters are reproducible with high diagnostic sensitivity and specificity for differentiate between healthy and glaucomatous eye[12,13]. The discriminating ability depends upon the severity of glaucoma. The technology shows better performance in advanced glaucoma compare to early stages of glaucoma[10]. The images of RNFL and ONH region cause accurate and reproducible parameters that include: average RFNL thickness, rim area, disc area, average cup-disc ratio, vertical cup-disc ratio, cup volume etc. The diagnostic capability of HD-OCT of glaucoma with age matched healthy control reported that RNFL and ONH parametersare able to discriminate between healthy and glaucomatous eye[14]. According to some study RNFL thickness is a better predictor for glaucoma diagnosis[13], but other diagnostic study also shows that both thinning of RFNL and structural change of ONH cause differentiation between glaucoma and healthy eyes.

Glaucoma progression

Detection of glaucoma progression is quite challenging due to variable slow progressive nature of the disease along with lack of commonly acceptable reference standard[1]. Updated Cirrus HD-OCT is more sensitive than previous versions in detecting changes in glaucoma progression.Though it is a challenge to discriminate between the glaucomatous structural damage and age related structural loss, cross sectional studies showed a negative correlation between age and average RNFL thickness[15].

Materials and Methods

A retrospective cross sectional study conducted on 185 eyes of 185 patients who were selected randomly from the outpatient department who were seeking care of glaucoma at Dhaka eye care Hospital. Among them OCT-ONH was advised to 74 patients for screening, to 44 patients as glaucoma suspect for early detection and to 67 patients to observe the disease progression. 82 of them were male and 103 were female. All subjects underwent a complete ophthalmic examination including visual acuity, manifest refraction, intraocular pressure measurement by non-contact tonometry, slit lamp examination, gonioscopy, color disc photography and optical coherence tomography by Cirrus HD-OCT 400. There were some

inclusion criteria and exclusion criteria for subject selection under study. The inclusion criteria were, the patient should have best corrected visual acuity not worse than 20/40, spherical equivalent refractive error within ±5.00D, astigmatism within ±3.00D, an open anterior chamber angle and reliable visual field result defined by <20% fixation loss and <25% false positive and false negative error. The exclusion criteria for the sample under study were, having history of uveitis or any retinal disease, ocular surgery other than cataract extraction, or any laser procedures, any disease that may affect peripapillary area where OCT measurements are obtained, optic disc anomalies such as coloboma or optic disc drusen and any kind of neurologic disease that can cause visual field defect.

Cirrus Spectral-Domain OCT

Subjects were measured with the optic disc cube 200 X 200 program of the Cirrus HD-OCT version 7.0.1.290. All Cirrus OCT scans were obtained after achieving pupillary dilatation. The image quality of Cirrus OCT scans were assessed by two experienced examiners. The minimum acceptable signal strength score was 6. The examiners subjectively assessed the image quality and evaluate the face image for eye movement[7]. The Cirrus OCT utilizes the same technique for RNFL scan. During scan presence of a centered circular ring around the optic disc is necessary. For macula and ONH scans, the radial scans had to be centered on the fovea and optic disc respectively.The neuroretinal rim area in each cross sectional scan was estimated by the area bounded using the reference plane. Data analysis of the scan incorporate and form the composite image measurement that includes average RNFL thickness, rim area, disc area, cup to disc area ratio, vertical cup to disc ratio and cup volume. Using these data Cirrus OCT provides four quadrant thickness and a global 360° average thickness. For each parameter, the Cirrus OCT software provides a classification (within normal limits, borderline or outside normal limits) based on comparison with an internal normative database[14]. A parameter is classified as outside normal limits if its value falls lower than 99% confidence interval of the healthy, age matched population. A borderline result indicate that the value is between 95% and 99% CI and a within normal limit indicates that the value is within 95% CI.On the deviation from normal map, a wedge- shaped yellow or red color radiating from the optic nerve head consider as RNFL defect. Also on the deviation from normal map, clock hour location of RNFL defects are shown in a clock faced circle of diameter[2]. Clock hours were assessed in a clockwise direction for right eye and in an anti clockwise direction for left eye, with the temporal sector set at 9 o'clock.

RFNL Thickness Measurement

The RNFL algorithm was used to obtain RNFL thickness with Cirrus OCT. Three images were taken during the test with each image consisting of 3.4mm diameter circular ring around the optic disc. RNFL thickness parameters were automatically calculated by existing Cirrus OCT software (version 7.0.1.290) and evaluation done on average thickness, temporal quadrant thickness, superior quadrant thickness, nasal quadrant thickness and inferior quadrant thickness. The average RNFL thickness and the inferior quadrant thickness of ONH parameters impose the best diagnostic accuracyfor glaucoma detection. Moreover, test sensitivity depends on superior quadrant thickness values and superior-inferior quadrants are most commonly affected by glaucoma[16].

Optic Nerve Head Measurement

In optic nerve head scanning, the device automatically determines the disc margin at the end of the retinal pigment epithelium layer. The demarcation of the edge of retinal pigment epithelium can be adjusted manually to improve the outline of the disc margin. According to some study, ONH parameters by OCT are reproducible[17]. Segmentation of ONH was greatly improved with new software. Referencing the fovea`s position and bruch`s

membrane as anatomic landmark cause better measurement of ONH rim[18]. However, rim area appears to be a more useful ONH parameter for detecting early glaucoma along with quantifying risk, diagnosis and management of glaucoma at different level of severity[19].

Statistical analysis

Statistical analysis was performed using SPSS software version 23. The relationships were considered significant if $p < 0.05$.Data were reported as mean ± standard deviation (SD). Analysis of variance (ANOVA) was done for multiple comparisons. Receiver operating characteristics (ROC) curves were used to describe the ability of each parameter to differentiate between glaucoma screening, glaucoma suspect and glaucoma progression groups. The ROC curve plots the proportion of false positives (specificity) against the proportion of true positives (sensitivity). The diagnostic performance of the test is then judged by its closeness to upper left corner of the graph, which is assessed quantitatively by the areas under receiver operating characteristics (AUCs). The AUC measures the diagnostic power of a test to classify normal and diseased. An AUC of 1 represents a perfect test with 100% sensitivity and specificity while an AUC 0.5 indicates completely worthless test. For this study, the AUC was classified as, 0.9 – 1= excellent, 0.80 – 0.89 =good, 0.70 – 0.79 = fair, 0.60 – 0.69 = poor and 0.50 – 0.59 = very poor test.

Result

The mean age of the patients of glaucoma screening group is 46.76±13.91 years, glaucoma suspect group 52.70±14.60 years and glaucoma progress group 52.97±12.09 years.

RNFL and ONH variables

Retinal Nerve Fibre Layer Thickness is 85.76±23.29 µm in glaucoma screening group. The thickness is gradually observed less in glaucoma suspect and glaucoma progress group which are 74.55±14.66 µm and 64.39± 15.26 µm respectively. [Table 1]

Table 1 : Demographic and clinical characteristics of study groups

Parameters	Glaucoma Screening	Glaucoma Suspect	Glaucoma Progress
Age (year)	46.76 ±13.91	52.70 ±14.60	52.97 ± 12.09
RNFL thickness (µm)	85.76 ±23.29	74.55 ± 14.66	64.39 ± 15.26
Rim Area (mm^2)	1.28 ± 0.47	1.01 ± 0.36	0.83 ± 0.36
Disc Area (mm^2)	2.19 ± 0.46	2.22 ± 0.49	2.08 ± 0.43
Average CDR	0.60 ± 0.20	0.72 ± 0.12	0.75 ± 0.15
Vertical CDR	0.56 ± 0.19	0.70 ± 0.12	0.74 ± 0.15
Cup volume (mm^3)	0.36 ± 0.29	0.48 ± 0.31	0.53 ± 0.39

Abbreviations: RNFL retinal nerve fibre layer, CDR cup disc ratio.

The ONH parameters are tabulated in table 1. Rim area showed highest 1.28mm^2 in glaucoma screening group. The disc area, average cup disc ratio, vertical cup disc ratio and cup volume show lowest value in glaucoma screening group and gradual higher value in glaucoma suspect and glaucoma progress group.

Affected RFNL quadrant

RNFL thickness when showed in RNFL quadrants also presents significant difference between sub groups. The most affected quadrant in glaucoma screening group is inferior quadrant. Glaucoma suspect group present the Superior-inferior quadrant as most affected and for glaucoma progress group three out of four quadrants was mostly affected. [Fig 1]

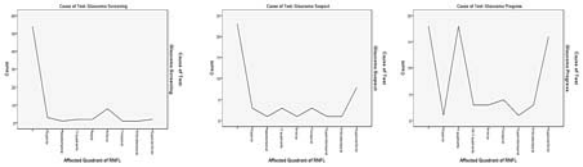

Figure 1: Affected quadrant in sub groups under study

ANOVA

The comparison between glaucoma screening, glaucoma suspect and glaucoma progress group was done by ANOVA test. The results showed statistically significant difference for almost all parameters ($p<0.05$) of all three groups under study. The rim area ($p=0.07$), disc area ($p=0.141$) and cup volume ($p=0.180$) of glaucoma suspect group show statistically insignificant difference. The retinal nerve fibre layer thickness of glaucoma progress group also

shows statistically insignificant difference (p=0.112). [Table 2]

Table 2: ANOVA test significance (P value) between three groups

Parameters	Screening group (Sig)	Suspect group (Sig)	Progress group (Sig)
RNFLT	0.000	0.001	0.112
RA	0.039	0.077	0.002
DA	0.008	0.141	0.001
ACDR	0.000	0.059	0.001
VCDR	0.000	0.020	0.000
CV	0.000	0.180	0.000

Abbreviations: RNFLT retinal nerve fibre layer thickness, RA rim area, DA disc area, ACDR average cup disc ratio, VCDR vertical cup disc ratio,CV cup volume.

ROC Curve

The AUC (area under receiver operating characteristic curve) of RNFL and ONH parameters were calculated to test the discrimination between the eyes for screening, for glaucoma suspect and for glaucoma progression. [Fig.2]

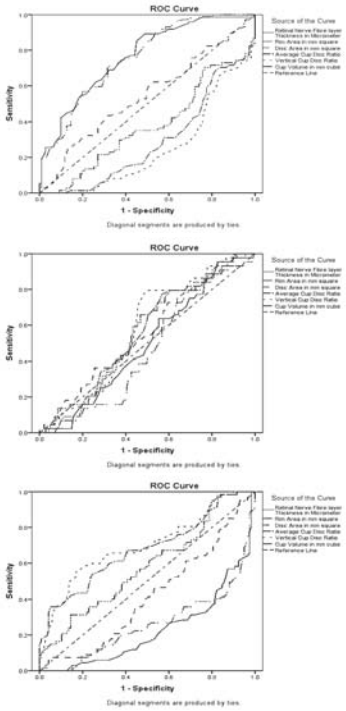

Figure 2 : ROC Curve for parameters to show the discrimination power

The retinal nerve fibre layer thickness seems to be a good parameter (AUC=0.832) in screening group, fair indicator (AUC=0.763) in suspect group and poor indicator (AUC= 0.632) in progress group to differentiate between normal and glaucomatous eye (p=0.00). The rim area alsoproved to be a good indicator (AUC=0.826) for screening groupamong the three groups (p=0.00). The disc area is a fair indicator (AUC = 0.759) for screening group (p=0.29) as well. The vertical cup disc ratio is a fair indicator for both suspect group (AUC=0.781) and progress group (AUC=0.759) with significant p value for both groups (p=0.04). Next to this the cup volume proved to be a fair indicator (AUC=0.732) for progress group (p=0.06) and poor indicator (AUC=0.695) for suspect group to differentiate between normal and glaucomatous eye. [table 3]

Table 3 : Area Under Receiver Operating Characteristics Curve values for each groups

Parameters	Screening group (AUC)	Suspect group (AUC)	Progress group (AUC)	p value
RFNLT	0.832	0.763	0.632	0.00
RA	0.826	0.759	0.536	0.00
DA	0.759	0.557	0.582	0.29
ACDR	0.636	0.521	0.448	0.65
VCDR	0.474	0.781	0.759	0.04
CV	0.412	0.699	0.732	0.06

Abbreviations : RNFLT retinal nerve fibre layer thickness, RA rim area, DA disc area, ACDR average cup disc ratio, VCDR vertical cup disc ratio,CV cup volume.

Discussion

The results of the study indicate that both RNFL and ONH parameters measured by Cirrus HD-OCT are useful for screening, suspects for early detection and progress of glaucoma by differentiate between normal and glaucomatous eye. The study also shows that the RFNL and ONH parameters have strong discriminating capability while test is for screening purpose. When test the suspect group for early detection or to observe the glaucoma progression, the parameters decrease the power of

differentiation.

When RNFL and ONH parameters were taken separately, average RNFL thickness shows highest discriminating performance between normal and glaucomatous eye. This observation is similar to that of Schuman, who compared the performance of macular and peripapillary RNFL measured by Cirrus HD-OCT and Stratus OCT to detect glaucoma and to test the hypothesis that HD OCT is better than Stratus OCT. With Cirrus HD-OCT, he found the average RNFL thickness and the inferior quadrant`s thickness as the best discriminators between normal and glaucomatous eye with AUC=0.737[21]. Interestingly two instruments showed similar discriminating ability with higher reproducibility for Cirrus HD-OCT but they are not interchangeable due to some systemic differences[21]. Kanamori et al also reported that the average RNFL thickness and the thickness in inferior quadrant were the best parameters to differentiate between normal and glaucoma effected eye. The study has got lower AUC than our study, may be due to different study population[22]. Manassakorn et al compare the RNFL thickness and ONH parameters by Stratus OCT. They found the average RNFL thickness, thickness at inferior quadrant and 7o`clock as the best discriminator between normal and the entire glaucomatous group[23]. Similar study was done by Yuksel et al, who included healthy, mild, moderate and severe glaucomatous eye for his study. He presented the inferior quadrant thickness (AUC=0.74) and average RNFL thickness (AUC =0.74) as the best parameters to discriminate between the sub groups[24]. Other studies done by Bourne et al compared the diagnostic accuracy of RNFL measurements, Chen and Huang evaluate the performance of RNFL quadrant sector among the normal and diseased eye[24,25,26]. Huang et al did the similar study on the basis of visual field damage and average RNFL thickness presented with AUC= 0.97[27]. Medeiros et al, Badala et al and Wollstein et al did the similar study with RNFL and ONH parameters and presented with higher sensitivity upto 84.6% and specificity upto 95%[28,29,30]. Software analysis of ONH parameters with Cirrus HD-OCT also presents AUCs for discrimination of healthy and glaucomatous eye. Similar to our study, the rim area (AUC=0.826) showed highest ability to discriminate healthy and diseased eye by Mwanza et al (AUC=0912)[14]. This may be the first study using Cirrus HD-OCT optic disc analysis. The diagnostic accuracy of ONH parameters to distinguish between normal and glaucomatous eye was measured by Leung et al where VCDR (AUC=0.962) and average CDR (AUC=0.960) had the highest ability[31]. Study done by Medeiros et al found rim area and CDR as the best discriminator of glaucoma stages with AUC 0.88 for each parameter[28]. Wollstein et al reported rim area (AUC=0.97) and CDR (AUC=0.94) as best discriminating parameter[30]. Study done by Deleon-Ortega, Manassakorn and Yuksel et al considered VCDR has the highest ability to differentiate healthy and diseased eye[23,24,32]. So, it can be said by analyzing all previous studies, rim area and VCDR holds utmost importance to differentiate between normal and other eyes with different levels of glaucomatous change.

Conclusion

Cirrus HD-OCT has changed the face of glaucoma assessment and research. It surely impacted upon the diagnosis and follow-up of this eye disease which is known as "silent killer of vision". By careful consideration of limitations like scan artifacts, OCT parameters such as retinal nerve fibre layer and optic nerve head should be used for early detection of glaucoma and following the disease progression of glaucoma and thus restore the valuable vision.

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Original Article

Visual Outcome after Manual Small Incision Cataract Surgery for Phacomorphic Glaucoma

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Abstract

Aim : To evaluate the visual outcome after manual small incision cataract surgery (MSICS) as a treatment of phacomorphic glaucoma.

Method : The study included 44 patients with phacomorphic glaucoma treated by manual small incision cataract surgery with intraocular lens implantation. Preoperative and postoperative visual acuity and intraocular pressure have been recorded and compared at the end of six weeks after surgery.

Result : The mean preoperative intraocular pressure was 35.20 (± 10.86) mm of Hg. There were no significant intraoperative complications such as posterior capsular tear or expulsive hemorrhage. Post operative mean intraocular pressure (IOP) was 12.48 (± 3.45) mm Hg. There was a statistically significant difference between IOP at presentation and IOP at last presentation. (P-＜0.0001).Pre operative visual acuity in all the affected eyes were perception of light with projection of rays in all quadrant. Postoperative best corrected visual acuity was 6/6-6/18 in 28 patients (62.80%), 6/24- 6/36 in 10 patients (23.25%) and 6/60 in 6 patients (13.95%).

Conclusion : Manual small incision cataract surgery is a safe and effective method of treatment with minimal or no complications for phacomorphic glaucoma and the visual outcome and IOP reduction is satisfactory.

Introduction

Cataract is the most common cause of avoidable blindness in the world. Bangladesh is one of the densely populated developing countries having about 700 thousand people blind. Cataract contributes 80 % of total blindness in Bangladesh[1]. Limited health care facility and other socioeconomic factors influence the patients for late presentation, sometimes with complication like phacolytic and phacomorphic glaucoma.

The definitive treatment for phacomorphic glaucoma is cataract extraction[6,8]. Surgery in a patient of phacomorphic glaucoma has to face some challenges. High intraocular pressure, increases the risk of expulsive haemorrhage, hypermaturity of lens is often associated with zonulolysis which makes surgery technically more difficult.Shallow anterior chamber may cause corneal touch that makes the cornea hazy.. Phacoemulsification is not possible for high intraocular pressure as well as for the inflammation.Conventional extracapsular cataract extraction (ECCE) has some limitations. Manual small incision cataract surgery is suitable for such phacomorphic glaucoma cases as it is relatively easy to approach and manage. The aim of our study is to evaluate the visual outcome and intraocular pressure after manual small incision cataract surgery in the management of phamorphic glaucoma.

Methods

This is a retrospective review of case series and was conducted at the glaucoma clinic of Chittagong Eye Infirmary and Training Complex, Bangladesh and was approved by institutional review board. A total of 43 patients with phacomorphic glaucoma were included in this study. The patients with inaccurate perception of light,combined mechanism where primary angle closure glaucoma was also associated, zonular dialysis and subluxation of lens where intraocular lens implantation was not possible were excluded from the study. Most of the patients in this study group came from remote area with poor socioeconomic background.

All of the patients presented with gradual loss of vision followed by sudden acute onset of pain

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with sudden loss of residual vision, redness in the affected eye. The diagnostic features were shallow anterior chamber and hypermature cataract with perception of light and raised intraocular pressure. Conjunctival congestion, corneal edema and inflammation in the anterior chamber were found in all cases. Lenticular changes were capsular calcification or thinning,cortical liquefaction,swelling of the lens,phacodonesis due to zonular weakness. All patients were treated medically prior surgery to reduce inflammation and intraocular pressure.

All 44 surgeries were done by a single surgeon. Raised intraocular pressure was usually with systemic carbonic anhydrase inhibitor or hyperosmotic agents prior to surgery to soften the eye ball.Ocular inflammation was reduced with frequent topical steroid usage.

Peribulbar block was given in all cases with short and long acting anesthetic agents. Superior rectus briddle suture was placed and superior limbus and adjacent conjunctiva were exposed. Fornix based conjunctival flap was made in the superior part and bleeding blood vessels were cauterized with wet field bipolar cautery. A partial thickness 6mm scleral incision was made 2mm behind the limbus and scleral tunnel was created up to 1mm of the clear cornea. Anterior chamber entry was done with 3.2 mm keratome. Reformation of the anterior chamber was done to create an environment for easy manipulation for the next step. A small perforation was made in the upper part of anterior capsule using a bent 26 G needle attached with a syringe and aspiration of the liquid cortex was done. The capsular bag was then inflated with viscoelastic substance and either continuous curvilinear capsulorrhexis(where possible) or canopener capsulotomy was done. .

The tunnel was enlarged on either side up to 6 mm with the help of crescent knife. The nucleus was prolapsed in the anterior chamber by rotation technique and removed by irrigating vectis. After aspiration of remaining cortex with simco cannula, anterior chamber and capsular bag was reformed with viscoelastic substances. A 6 mm PMMA lens was then inserted in the capsular bag and proper positioning was done by dialer. Aspiration of viscoelastic material was done and anterior chamber was reformed with ringer lactate solution. Self sealed limbal wound was covered with conjunctival flap.

Post operatively all patients were treated with topical cycloplegic, steroid and antibiotic. Total ophthalmic examination was done on first post operative day and then one week and six weeks after operation. Detailed ophthalmic examination was done in each follow up.

Results

The demographic details of the 43 patients are showed in Table 1: Mean age of the patients was 59.65 (± 10.44) years and among them 24 were male and 20 female. The fellow eyes of the study patients were cataract in 24 cases (53.49 %), pseudophakic in 15 cases (34.88 %) and aphakic in 5 cases (11.63 %). Mean duration of acute symptoms like pain redness and photophobia was 8.18(±3.60SD) days. Among them most of the patients have a duration of 0-10 days. Preoperative visual acuity was perception of light with projection of rays in all quadrants in all affected cases.

Table 1: Demographic characteristics of the study population

Demographics	Number of Patients (%)
Age (Years)	
Mean (± SD)	59.65 (± 10.44)
Range	40-85
Gender	
Male	23
Female	20
Operated Eye	
Right Eye	20 (46.52 %)
Left Eye	23 (53.48 %)
Status of Fellow Eye	
Cataract	23 (53.49)
Pseudophakia	15 (34.88)
Apahakia	5 (11.63)
Duration of Symptoms (Days)	
Mean (± SD)	9.18 (± 3.60)
0-10 Days	31 (69.8)
11-16 days	11 (25.6)
17-22 days	2 (4.7)
Visual acuity	
Light perception with projection of rays	100%

Pre-operative and post-operative visual acuity was shown in Table-2: Best corrected visual

acuity at six week follow up was ³ 6/18 in 62.80% cases, between 6/24-6/36 in 23.25% cases and 6/60 in 13.95% cases. Among the all patients 86% cases had postoperative best corrected visual acuity ³ 6/36. The mean refractive status at six weeks follow up was +1.50D cylinder (range +0.5 to +2.5 D) and the median axis was 180^0.

Table 2 : Comparison of pre-operative and postoperative visual acuity

Visual Acuity	Pre-Op Uncorrected	Post-op Best Corrected
6/6-6/18	0 (0.0%)	28 (62.80%)
6/24-6/36	0 (0.0%)	10 (23.25%)
< 6/60	43 (100.0%)	6 (13.95%)

The pre operative intraocular pressure ranges from 22-60 mm Hg with the mean of 36.23 (± 10.86) mm Hg. Post operative intraocular pressure ranges from 5-22 mm Hg with the mean of 12.5 (±3.45) mm Hg. (Table: 3).

Table 3 : Comparison of pre-operative and postoperative IOP

IOP mmHg	Preoperative
Mean	35.20 (± 10.86)
Range	22 - 60
20 - 29	11 (25.6 %)
30 - 39	13 (30.2 %)
40 - 49	13 (30.2 %)
50 - 60	6 (14.0 %)
IOP mmHg	Postoperative
Mean	12.48 (± 3.45)
Range	5 - 22
5 - 8	6 (14.0%)
9 - 12	18 (41.9%)
13 - 16	16 (37.2%)
17 - 22	3 (7.0%)

Discussion

The result of this study showed good visual outcome after manual small incision cataract surgery in patients with phacomorphic glaucoma. Phacomorphic glaucoma is caused by an obstruction of pupil by swollen lens. Extracapsular cataract extraction needs large incision and more surgical manipulation. So there is always a high risk of expulsive hemorrhage and severe post operative inflammation.

Phacoemulsification is not suitable in phacomorphic glaucoma, because the nucleus is swollen,very shallow anterior chamber,high IOP,compromised zonules as well as severe inflammation in almost all cases. There is also a risk of endothelial damage, zonular dialysis, and posterior capsular tear. But in MSICS causing less stress on the zonules, does not need expensive equipments and anterior chamber is more stable due to shelving scleral wound. In this study MSICS gives satisfactory uncorrected vision as it has a low range of post operative astigmatism.

At six weeks visit, 28 patients (62.80%) had best corrected visual acuity (BCVA) of ³ 6/18, 10 patients (23.25%) had BCVA between 6/24-6/36 and 6 patients had 6/60. This compares favorably with other series in which ECCE was performed in the lens induced glaucoma [4,12,19,20]. Post operative visual acuity was not appreciable in 6 patients in comparison to others. The reason behind the poor visual outcome in this

Figure-1 : Phacomorphic glaucoma at presentation

Figure-2 : Phacomorphic glaucoma -6 weeks after surgery

group was late presentation of the patient which causes more inflammation and corneal decompensation due to prolong raised pre operative intraocular pressure. The mean post operative astigmatism of our patient is comparable to a series where MSICS was performed in 191 eyes of lens induced glaucoma where the mean astigmatism was 1.20D[20]. Most of the cases in our study the steep axis was 180^0, whose vision were improved with refraction, possibly due to relaxation caused by the superior scleral incision.

The result of post operative visual acuity in our study group is also similar to the result of Venkatesh et al where they showed the post operative outcomes of 33 patients after MSICS in lens induced glaucoma cases.[23] The result is also very much similar with the study of Ramakrishanan R who showed thepost operative visual outcome as well as IOP control after MCECS in phacomorphic glaucoma cases.24 Post operative IOP in all cases was controlled without the need for long term anti-glaucoma medications. This is similar to other studies where ECCE performed for lens induced glaucoma.[4,12,19]

Conclusion

In a developing country like Bangladesh, phacomorphic glaucoma is not an uncommon disease due to limited eye care facilities, ignorance and also economical barrier. Our study demonstrates that, MSICS is a safe and effective treatment for the patient with phacomorphic glaucoma due to satisfactory post operative visual outcome and adequate control of intraocular pressure without anti glaucoma medication.

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New Technique
Ahmad Glaucoma Valve and Paul Glaucoma Implant in PACG

M N Islam[1]

Abstract

Surgical management of angle closure glaucoma (ACG) is an integral part of glaucoma patient care. The effectiveness of the different surgical treatment options depends on the anatomy of angle closure eyes. Filtration surgery (Trabeculectomy) with few modifications is being done for ACG. Filtration surgery for ACG are different than those for open angle glaucoma and depend upon some factors such as the extent of IOP control with medications and the presence of coexisting cataract. The outcome of filtration surgery for angle closure glaucoma seems to be less favorable than for open angle glaucoma as because of higher risk of filtration failure. Thefiltration surgerycan also increase the chance of further shallowing of the anterior chamber, the risk of developing malignant glaucoma, and the risk of cataract formation. Glaucoma Drainage Devices (GDD) eg. Ahmad Glaucoma Valve (AGV), Paul Glaucoma Implant (PGI) is useful in some refractory ACG and in the failed filtration surgery cases.

Key words: Angle closure glaucoma; Filtration surgery; Trabeculectomy; Shallow anterior chamber; Glaucoma Drainage Devices, Ahmad Glaucoma Valve, Paul Glaucoma Implant.

Introduction

It has been estimated that worldwide 5.3 million people with glaucomawill be blind due to primary angle closure glaucoma (PACG)by 2020.Among them 86% people with PACG are in Asia,with approximately 48.0% in China, 23.9% in India and 14.1%in southeast Asia[1]

Management of patients with Primary Angle Closure (PAC) depends on the various typeof clinical presentation (PACS, PAC or PACG) andits underlyingpathophysiology. Treatment options for PACG may be medical, laserand/or surgical. The two main challenges in the treatment of PACG are to prevent progression of the angle closure and then to prevent progression of the glaucomatous optic neuropathy by controlling intra ocular pressure (IOP). Various surgical procedures have different potentiality for the treatment of this kind of PACG.

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Glaucoma drainage implant in Angle Closure Glaucoma

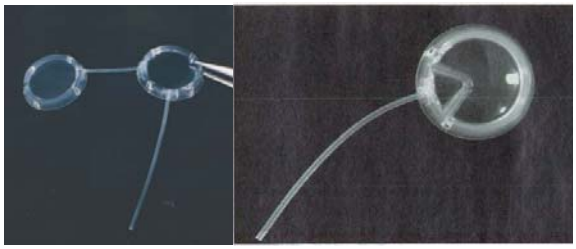
Currently there is a wide variety of glaucoma drainage devices (GDD) such asMolteno implant, Baerveldt, Aurolab Aqueous Drainage Implant(AADI), Ahmad Glaucoma Valve are being used for both open and closed angle refractory glaucoma. Overall, the GDD success rate for controlling IOP for complicated cases range from 70-90%. Glaucoma drainage device implantis technically more difficult than trabeculectomy, and potentially serious complications can occur. Mostly the use of a glaucoma implant for ACG has been confined to those patients in whom one or more previous filtering procedures have failed.Other indications for glaucoma drainagedevice implant in the closed angle includeUveitic glaucoma, Neovascular glaucomaand glaucomaafter cataract extraction or other types of ocular surgery. In some study it was found trabeculectomy was successful in only one third of patients, regardless of whether MMC was used or not during these refractory glaucoma surgery.[20]

GDD used in Angle Closure Glaucoma may be valvedor nonvalved devices. Usually it is the surgeon's choice which device he or she wants to use. Recently PGI is being used more in the shallow anterior chamber as its tube is smaller in size and takes little space in the AC.

Non valve open tube drainage devices

Molteno Implant

This is the prototype drainage implant device and has had the longest and most extensive clinical experience since Molteno introduced it in 1969. The original design consists of a single plate of thinacrylic with a diameter of 13 mm and an area of 135 mm^2. A silicone tube with an external diameter of 0.62 mm and an internal diameter of 0.30 mm connects to the upper surface of the plate.[21, 22]



Baerveldt Implant

The unique feature of this popular nonvalve drainage implant is the large surface area of the plates, which are designed in such a way that they can be easily implanted through a one-quadrant conjunctival incision. A silicone tube is attached to a soft barium-impregnated silicone plate with a surface area of 250 mm^2 (20 mm × 13 mm) or 350 mm^2 (32 mm × 14 mm).[23] The plate is typically positioned under the rectus muscle insertions, usually in the superotemporalquadrant. The Baerveldt plate has fenestrations that allow growth of fibrous tissue through the plate. The fibrous tissuehelps to secure the implant and reduce the height of the bleb, which decreases the risk for diplopia. A fibrous capsule forms after the first 3 to 6 postoperative weeks into which fluid can drain and from which fluid can be absorbed by the surrounding tissues.

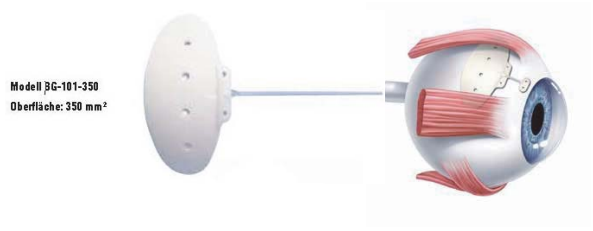


Figure : Baerveldt Implant

Aurolab Aqueous Drainage Implant(AADI)

AADI is a glaucoma drainage device. It is designed and manufactured by Aravind Eye Care,India, similar to the Baerveldtimplant. A silicone tube is attached to a silicone plate with a surface area of 350 mm^2 with Plate length 32 mm and Tube length 35 mm.[24]

Figure: AADI implant

Paul Glaucoma Implant (PGI)

PAUL® Glaucoma Implant is a micro-sized tubed aqueous shunt for PAUL Stability® System. It is also a non valved tube, designed to regulate glaucoma or raised intraocular pressure. Provides a stable & well-formed anterior chamber

post-implantation in the immediate post-operation month.The device is constructed from medical implantable grade silicone and has a length of 44.9mm, width of 23mm and an extraocular plate surface area of 342.1 mm^2

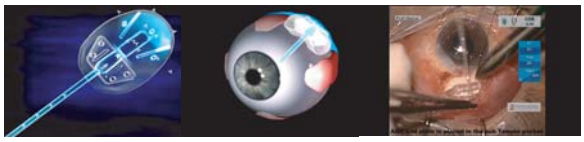
Valved or Flow Restricted Drainage Devices

Ahmad Glaucoma Valve (AGV) implant

The Ahmed glaucoma valve implant is one of the most commonly used valved implants inrefractory glaucoma including angle closure glaucoma. Two models are in use- FP7 which has a silicone body (Paediatric counterpart FP 8) and S2 which uses a propylene body (Paediatric counterpart S3). Aqueous outflowhas little resistance through this valved device until the plate becomes encapsulated. The incorporation of a valve mechanism in implants seems todecrease early postoperative hypotony by providing resistance to the flow and therefore regulating the pressure within a desired range.[25]

Ahmed drainage device can also be implanted

with per operative use of MMC sponge to result in a lower target IOP.



Courtesy: www.newworldmedical.com

Krupin Implants

In 1976, Krupin and associates introduced the concept of a oneway valve that opens at a predetermined IOP level to avoid the early postoperative complications of excessive drainage and hypotony. The valve effect was created by making slits in the closed external end of the silastic tube, designed to open at an IOP between 9 and 11 mm Hg. This device less commonly used in clinical practice.[26]

Courtesy: www.google .com

Surgical techniques of AGV implant&PGI in Angle Closure Glaucoma

Surgical techniques of AGV implant in ACG is similar to as in Open angle glaucoma except insertion of tube in the anterior chamber. Sometime the AC is very shallow that tube cannot be placed in AC and then it can be placed through the pars plana to the anterior vitreous cavity after partial pars plana anterior vitrectomy.

The following are the steps for AGV implant.

Surgical exposure

- Adequate surgical exposure is dependent on proper placement of a traction suture. A 6-0 polyglactin (Vicryl) or silk traction suture on a spatulated needle is placed through superficial cornea near thesuperior limbus and attached to the drape beneath the eye.
- A fornix-based conjunctiva -tenons capsule flap is created, usually in the superotemporal quadrant, to expose the scleral bed. Radial relaxing incisions on both sides of the conjunctival flap can improve surgical exposure. For the non valved open type of GDD, a muscle hook is then used to isolate the two rectus muscles on either side of the surgical site.

Valve implants

- With Ahmed valve implants, priming should be done with balanced salt solution(BSS) using 27-gauge cannula, before the insertion into the anterior chamber. It should beensured that the valve opens properly and BSS passes freely.The external plate is then tucked posteriorly into the sub-tenon space and is sutured to sclera with absorbable 9/0, 8/0 vicryl or with nonabsorbable 9/0prolene or nylon sutures through the anterior positional holes of the plate.The anterior border of the plate should be at 8 to 10 mm posterior to the limbus.

PGI - Non valve Devices

- With nonvalved devices, restriction of aqueous flow to avoid severe early postoperative hypotony can be achieved by occluding the tube. The silicon tube is ligated with 6/0 or 7/0 Vicryl before inserting it into the anterior chamber. For PGI a 6/0 proline suture can be used as a ripcord or internal stent in the tube lumen so external tube ligature is not needed.
- Injection of a balanced salt solution with a 30-gauge cannula into the tube helps to confirm that the tube is totally occluded. This procedure prevents any drainage of aqueous until 4 to 6 weeks after the operation when the Vicryl suture dissolves, allowing aqueous to drain into the preformed capsule.
- The tube is then cut, bevel up, to permit its extension 1.5 to 2 mm into the anterior chamber. A paracentesis is made to allow placement of a small amount of viscoelastic in the anterior chamber. It is best to maintain the anterior chamber at a normal depth and avoid displacing iris posteriorly. Excess viscoelastics will produce unusual deep AC and anatomical misplacement of tube insertion in the anterior chamber.

In the anterior chamber

- The anterior chamber is then entered by a 26 -gauge needle (Narrow trac compare to AGV),

parallel to the iris plane. The needle creates a watertight seal, preventing leakage around the tube and thus reducing the risk for postoperative hypotony.

- The tube is then inserted into the anterior chamber via the needle track; there are specially designed tube-insertion forceps, but Moorfield Forceps also can be used. The tube can be secured to the sclera by using a nonabsorbable suture, such as 9/0 or 10/0 nylon.
- The anterior chamber may need to be formed with balanced salt solution, or viscoelastic, via the paracentesis, and the tube is checked for proper position in the anterior chamber.
- To cover the exposed tube , most surgeon suture a rectangle of preserved donor tissue of approximately 4 mm × 7 mm over the tube at the limbus. Processed pericardium, donor sclera, dura, and fascia lata are available commercially for this purpose. In most of my casesI coverthe tube under partialthickness long scleral flap. The conjunctiva is then sutured back to its original position using 8/0 vicryl sutures.

Subconjunctival medications

- Subconjunctival steroids and antibiotics are injected at the completion of the procedure in a quadrant away from the surgical site. The basic postoperative management is the same as that forfiltering surgery, using topical steroid-antibiotic and mydriatic-cycloplegic preparations for the first several weeks.

Figure: Surgical Steps of AGV implant

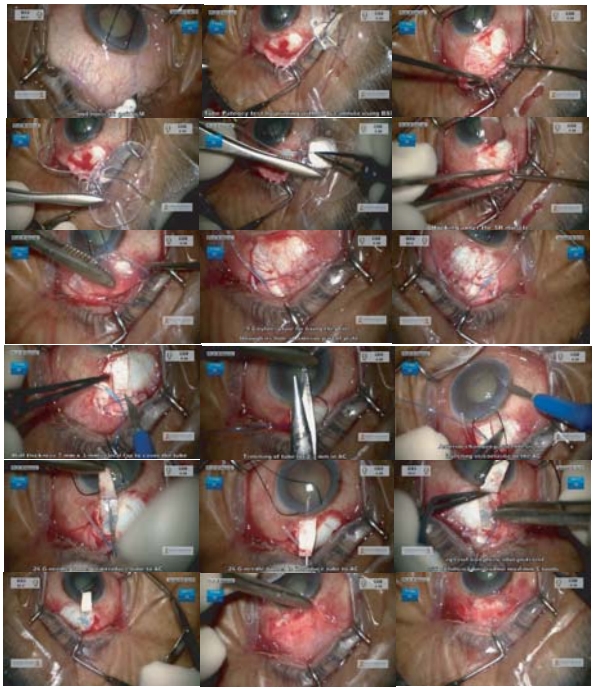


Fig: Surgical procedures of PGI

Closure of Conjunctival flap

Like in all types of glaucoma , water tight closure of conjunctival flap is also required in the Angle Closure Glaucoma. Otherwise a leaking wound may lead to a flat AC or a flat bleb or both. This may lead to hypotony and its complications e.g. maculopathy , suprachoroidal effusion etc. Manny surgeons use 2/3 interrupted sutures to close conjunctival flap, specially in the Open Angle Glaucoma cases.[12] In Angle Closure Glaucoma the conjunctival flap closure should be more precise and my practice is to do horizontal running mattress suture from one end to the other. Absorbable suture 8/0, 9/0 or 10/0 with a fine tapered needle can be used. I use 8/0 vicryl in most of my cases.

After conjunctival closure it is better to examine by fluorescein, coating the bleb surface and to see whether any bleb leak is present. If any leak is found, then further scleral flap suture or conjunctival suture or both may be needed. Fluorescein angiographic studies of eyes with successful trabeculectomies showed that primary route of external filtration to be around the margins of the scleral flap depending on

how tightly the flap is sutured or the thickness of the scleral flap is done [13]. Though usually in the OAG, the scleral flap is half thickness but in the Angle Closure Glaucoma the flap needs to be slightly more thicker (not more than 2/3rds) and sutures should be more tight. One or 2 sutures can be given releasable. It helps to maintain the AC postoperatively. In the event of early post operative higher IOP, suture can be released in the releasable suture cases, and argon/diode laser suture lysis can be done in the other cases.[14]

Complications of AGV & PGI [27]

With both AGV and PGI might have per op and post op complicationseg:

Hypotony: Until the fibrous capsule has developed around the external plate to regulate aqueous flow, the open, nonvalve drainage devices, provide very low resistance to flow, and hypotony in the early postoperative course.

Elevated Intraocular Pressure: Glaucoma drainagedevice procedures can also be complicated by elevated IOP in the early or the late postoperative period. Before the ligature around the tube dissolves, there may be a transient elevation of the IOP. It can be prevented by combining a trabeculectomy without mitomycin C with the drainage device, or it can be managed medically.[28]

Migration, Extrusion, and Erosion: Tube migration may occur after glaucoma drainagedevice procedures. If the tube is not adequately secured to the sclera, it may migrate posteriorly out of the anterior chamber. In that case it may require repositioning of the tube and securing it to the sclera with additional 9-0 Prolene sutures. Anterior migration of the tube can occur due to the dislocation of the external plate.

Endophthalmitis: Endophthalmitis is less common in the Tube versus Trabeculectomy (TVT) study.[29] Early postoperative endophthalmitis after placement of a glaucoma drainage device may be successfully treated by immediate removal of the implant. Exposure of the tube seems to be a major risk factor for these infections. Surgical revision with a patch graft in all cases in which a tube is exposed is indicated to prevent this potentially devastating complication.

Diplopia and Ocular Motility Disturbance: Diplopia usually noted in the devices with larger plates, especially when implanted in the superonasal quadrant. The devicecan interrupt extraocular muscle function and cause strabismus and diplopia. Characteristic patterns of which are exotropia, hypertropia, or limitation of ocular rotations.

Retinal complications with glaucoma drainage devices include retinal detachment, suprachoroidal hemorrhage, choroidal effusions, and vitreous hemorrhages. The most common risk factors for suprachoroidal hemorrhage are older age, postoperative choroidal effusions, low IOP immediately after the tube opened, hypertension, or atherosclerosis. To decrease the rate of retinal complications, complete ligation of the proximal part of the opentube with a 6/0 Vicryl suture and testing for watertightness before placing the tube in the anterior chamber is required.

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Steroid Induced Glaucoma – An Avoidable Secondary Glaucoma

M S I Prodhan[1], Z. S. Shahid[2], M M Hoque[3]

Abstract

Steroids are a group of anti-inflammatory drugs, commonly used to treat ocular and systemic conditions. Self-medication and injudicious use of steroids especially in eye drop formulations is responsible for steroid induced glaucoma.

Other common ocular side effect is cataract. Steroid-induced ocular hypertension was reported in 1950, when long-term use of systemic steroid was shown to increase the intraocular pressure (IOP). Chronic use of steroids in any form with raised IOP can cause optic neuropathy resulting in steroid-induced glaucoma.

This article briefly reviews the literature of steroid-induced ocular hypertension and glaucoma. This review describes the prevalence, risk factors and pathophysiology, prevention and treatment of steroid-induced glaucoma. The purpose is to familiarize all clinicians with the potential dangers of administering steroids without monitoring the eye and the dangers of irreversible blind -ness in some instances of habitual self-prescription by patients.

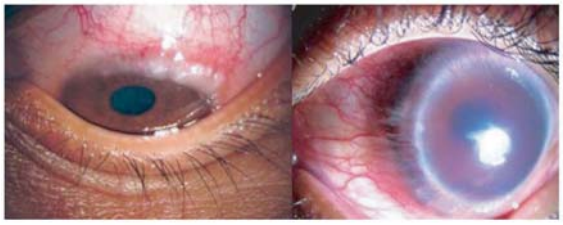
Keywords : Glaucoma, Intraocular pressure, Steroid response, Secondary open-angle glaucoma.

Introduction

Association of steroids and glaucoma was first reported in 1950, when systemic administration of adrenocorticotropin hormone (ACTH) was shown to increase intraocular pressure (IOP).[1] Intraocular pressure elevation in response to topical steroids was first reported by Armaly[2] and Becker.[3]

Steroid-induced glaucoma is a form of secondary open-angle glaucoma, earlier believed to result only after indiscriminate topical steroid use. Other routes of administration, such as oral,[3] intravenous, periocular,[4] dermatological,[5] intravitreal, intranasal[6-10] are also responsible for this devastating and irreversible visual loss due to ensuing glaucoma. Incidence of elevated IOP is less with intravenous, parenteral, dermatological and inhaled routes of administration.

The diseases where steroid use is rampant in the cases of itchy eyes, vernal, atopic kerato-conjunctivitis (Fig. 1) with unscrupulous, unregistered and ignorant practitioners of medicine. Owing to the quick relief of the red and itchy eyes, these drugs are used randomly on a regular basis leading to a state of complete self



and unmonitored treatment. Steroid-induced glaucoma is more common in young subjects, so extent of morbidity with blind years is prolong for a long life expectancy of these younger subjects. Vernal keratoconjunctivitis (VKC) with injudicious use of topical steroids has most commonly been associated with steroid-induced glaucoma.[12-15] Palpabral variety has been associated in a large series of glaucoma.[11] In a study by Sihota et al15 mixed variety was most common.

Bonini et al[16] in a long term review of vernal kerato-conjunctivitis recorded a 2% incidence of steroid-induced glaucoma. Other ocular routes of administration of steriods causing glaucoma are intravitreal,[17,18] subtenon,[19] radial keratomy[20] and after scleral reinforcement procedure.[21] Unmonitored use of topical steroids after laser in situ keratomileusis (LASIK) in predisposed patients can result in steroid-induced glaucoma.[63] Steroid use in other ocular conditions like chronic or recurrent uveitis can

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also result in rise of intraocular pressure.

Definition of Steroid Responder

Normal population response to steroids can be graded as nonresponders, responders and super responders. According to study done by Becker[2] in 1965, all primary open-angle glaucoma patients showed IOP rise with administration of topical Betamethasone 0.1%. Among normal individuals also two types of responses were observed 70% showed small rise of IOP while 30% showed high pressure response to topical steroid administration.

Becker's Study Design

Becker

Topical Betamethasone 0.1% was used for 6 weeks

Based on response

1. POAG-homozygous for responsive trait (gg)

Normal population divided into:

- Heterozygous (ng), who respond to steroids
- Homozygous (nn) non-responders.

% IOP rise seen in all categories.

Category	> 20 mm Hg	> 31 mm Hg
Primary open-angle glaucoma (untreated)	100	92
Offspring	87	19
Suspects	98	24
Volunteers	30	4

Armaly's Study Design

Armaly

Topical Dexamethasone 0.1% was used for 4 weeks

Response

Group IA: IOP rise of 1.6 ± 2 mm Hg seen in 66% normal population, hypertensive response attained in 2 weeks, maximum in 4 weeks.

Group IIA: IOP rise of 10 ± 2 mm Hg seen in 28.8% normal population.

Group IIB: IOP rise of >16 mm Hg seen in 5% normal population.

Group IA and Group IIB: IOP continued to increase throughout 4 weeks.

Once the steroids were withdrawn, most of the eyes returned to the baseline level within 3 weeks.[18] Few cases of irreversible elevation of IOP after subtenon injection of triamcinolone requiring filtering surgery are also reported.[19] It has been reported that the elevation of IOP resulting after systemic steroid administration is much less as compared to topical steroids.[20]

Pathophysiology

Glucocorticoids decrease the aqueous outflow by unknown mechanism. The most common explanation for this has been accumulation of glycosaminoglycans in the trabecular meshwork by glucocorticoids,[23] by stabilizing lysosomal membranes and inhibiting the release of catabolic enzymes. A variety of substances contributing to the extracellular matrix is secreted by cultured trabecular meshwork cells. Treating cultured trabecular cells with steroid induces the secretion of elastin, which may have a role in obstruction of trabecular meshwork.[24] Other hypotheses are an inhibition of the phagocytosis of foreign matter by trabecular endothelial cells[25] and decreased synthesis of prostaglandins that regulate aqueous humor outflow.[26] Southren[27,28] and Weinstein et al[29] found abnormal glucocorticoid metabolism in trabecular tissue from patients with primary open-angle glaucoma (POAG). This finding may explain the increased susceptibility of patients with POAG to the ocular hypertensive effects of glucocorticoids.

Cultured human trabecular meshwork cells secrete increased amounts of laminin and integrin when exposed to dexamethasone, and similar mechanism may be operative in vivo.[30] Other changes include thickening of the trabecular beams, alteration in F-actin architecture, increased cross-linked actin and induction of myocilin protein,[31,32] which may have a role in trabecular obstruction in vivo. It has been reported that histochemical studies of trabeculectomy specimens when stained with Alcian blue, PAS and colloidal iron in steroid-induced glaucoma contained acid mucopolysaccharides in the outflow channels. It is suggested that corticosteroids cause rise of

intraocular pressure acting through acid mucopolysaccharides but the exact mechanism is not known.

Risk Factors

Certain groups were found to have higher rates of steroid responsiveness, including persons with diagnosed primary open- angle glaucoma (POAG).[35] Approximately, one-third of glaucoma suspects and more than 90% of POAG patients responded with an IOP elevation greater than 6 mm Hg after receiving a 4-week course of topical dexamethasone 0.1%,[36,37] first-degree relatives of POAG patients increased one's susceptibility to being a steroid-responder.[38,39] IOP elevations are more prominent in older adults compared with younger adults.[38]

However, children are also at risk for an increased IOP in response to steroids. Lam et al found that 71 and 59% of children receiving topical dexamethasone 0.1% (qid and bid respectively) had a subsequent IOP measurement greater than 21 mm Hg.[40] Of those children receiving dexamethasone qid or bid, 36 and 21% respectively had an IOP greater than 30 mm Hg. Age, as a risk factor, appears to occur in a bimodal distribution peaking first at age of 6 years. As one progresses through adulthood, the risk rises again in late adulthood. Diabetes,[41] high myopia and connective tissue disease are the other associations.

Genetics: Upregulation of myocilin gene by dexamethasone led many investigators to believe that myocilin gene induction may be involved in steroid-induced glaucoma.[42,43] However, a putative association between MYOC induction and OAG has not been firmly established.[44-47]

Epidemiology

Armaly et al indicated that approximately one-third of normal eyes and more than 90% of patients with primary open-angle glaucoma respond with greater than 6 mm Hg of IOP elevation after receiving a 4-week course of topical dexamethasone 0.1%.[36,37]

About 30 to 50% of patients receiving intravitreal triamcinolone acetonide develop increased intraocular pressure (IOP).[48-50] Although, the most reported cases of steroid-induced glaucoma are transient and managed with topical medications, progressive optic nerve damage has been reported but not demonstrated by visual field defects.[49]

Natural Course

Steroid-induced damage of optic nerve is nonprogressive and further progression ceases with discontinuation of steroids.[51] Espildora et al[52] studied[22] patients with cortisone-induced glaucoma and reported that patients, who had instilled the medication for less than 8 weeks recovered normal ocular pressure after discontinuation of the cortisoe. On the contrary, those who had employed the corticoid for more than 4 years did not regain normal ocular tension, and medical treatment or even surgical therapy in a large number of cases had to be employed. Thus, a prolonged use of steroids seems to lead to greater ocular damage. In a study by Sihota et al,[15] all patients could be taken off treatment at 18 months. The duration of steroid use does not determine the IOP rise. Godel et al[53] noted that the duration of treatment with systemic steroids was not associated with the rise in IOP. Acute rise of IOP within hours has been reported in open-angle glaucoma cases with the use of intensive steroid therapy and with the topical use of potent steroids.[51]

Prevention

Low potency steroids like fluorometholone were postulated as non-IOP raising steroids, but caution is needed as they have been reported to cause IOP spike in susceptible individuals.[54] Studies done with steroids like loteprednol etabonate, which rapidly degrades into an inactive metabolite have not shown rise of IOP even in steroid responders.[55,56] Self medication and injudicious use of steroid should be avoided. Careful monitoring of the patients on corticosteroids (especially those with a family history of glaucoma) is essential.

Treatment

Cessation of steroid therapy at the earliest is the first line of defense. Chronic form abates in 1 to 4 weeks and acute form resolves in hours.51 Glaucoma may persist in spite of stopping steroids in some cases. In study by Francois et al glaucoma persisted in 2.8% of patients and they had a family history of glaucoma.[57] Duration of steroid therapy also influences reversibility of IOP elevation. Espilodora et al[52] reported normalizing of IOP in cases where steroids were used for less than 2 months and chronic elevation of IOP in cases where it was used for more than 4 years. Antiglaucoma drugs have to be instituted depending on the baseline IOP. Prostaglandin analogs, alpha agonists, beta-blockers can be prescribed alone or in combination depending on baseline IOP. Scherer et al[58] have reported a 28% decrease in IOP with latanoprost in eyes having steroid-induced glaucoma. Prostaglandin analogs have been found to increase redness in eyes with VKC.[14] Younger age of onset, high baseline IOP and greater glaucomatous optic neuropathy are more likely to need surgery. A study of juvenile glaucomas found that four of 11 steroid induced glaucoma eyes (36.6%) required surgery.[14] In a study by Honjo et al[59] success rate was of 83% in 5 years for trabeculectomy in the cases of steroid-induced glaucoma. Alternate treatment for exacerbation of VKC is needed in patients not responding to conventional drugs like mast cell stabilizers and antihistaminics. Topical cyclosporin drops in a concentration of 2% are used as steriod sparing agents in VKC.[60] Recent studies have found similar efficacy of low dose cyclosporin in a concentration of 1 and 0.05%.[61]

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Imaging In Glaucoma

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Abstract

The purpose of the review is to provide an update on the role of imaging devices in the diagnosis and follow-up of glaucoma with an emphasis on techniques for detecting glaucomatous progression and the newer spectral domain optical coherence tomography instruments.

Imaging instruments provide objective quantitative measures of the optic disc and the retinal nerve fiber layer and are increasingly utilized in clinical practice. This review will summarize the recent enhancements in confocal scanning laser ophthalmoscopy, scanning laser polarimetry, and optical coherence tomography with an emphasis on how to utilize these techniques to manage glaucoma patients

Keywords: Confocal scanning laser ophthalmoscopy, glaucomatous progression, optical coherence tomography, retinal nerve fiber layer, scanning laser polarimetry

Glaucoma results from accelerated loss of retinal ganglion cells (RGCs) and their axons, leading to retinal nerve fiber layer (RNFL) attenuation and optic neuropathy.

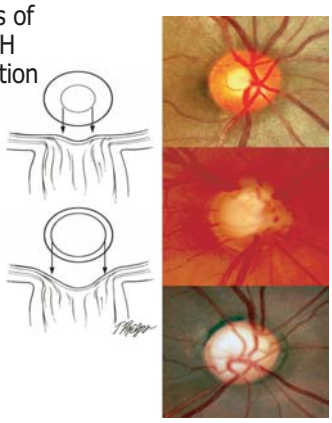
Glaucomatous damage is characterized by specific pattern of damage to the optic nerve head (ONH) and visual field loss.

Established methods for detecting these changes include clinical examination of the ONH and RNFL, optic disc stereophotography, and fundus photography.

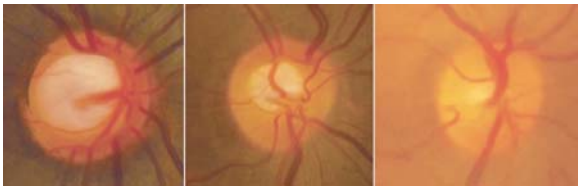
A change in the appearance of the ONH is the most important indicator for diagnosis as well as for detecting progression of glaucoma.

Consecutive photographs of the optic nerve head is necessary for documentation
To monitor the progress of
Glaucoma following ONH
Signs Need Documentation

1. Cup : Disc ratio

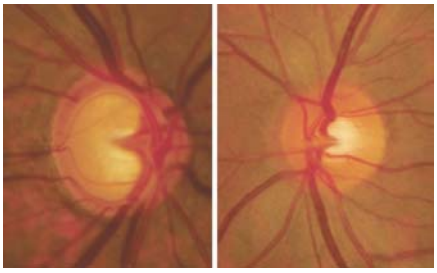


Size of the cup in relation to the size of ONH



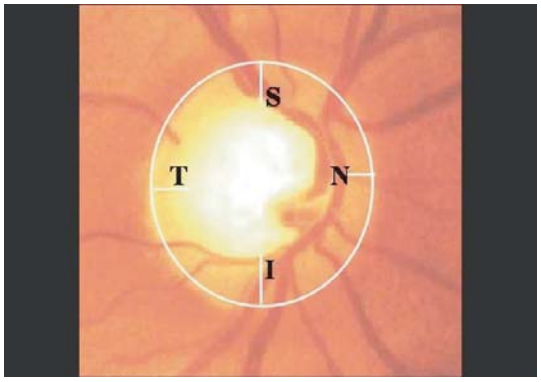
Large disk with large cup, average size disk with average sized cup and no cup in a small disk

2. Asymmetry of the cup



The difference in 2 eyes of same patient. The right eye is larger with larger CD ratio and thinner NRR. Asymmetry in CD ratio is due to disk size and also glaucomatous Involvement of the NRR

3. Neuro retinal rim



Normally

a. Inferior rim is thicker than superior rim

b. Which in turn is thicker than nasal rim. Temporal rim is thinnest

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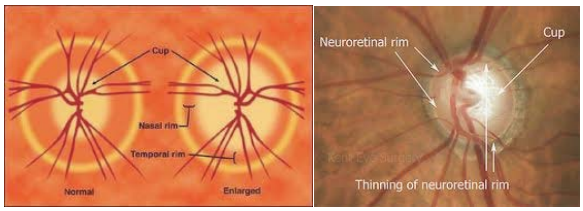
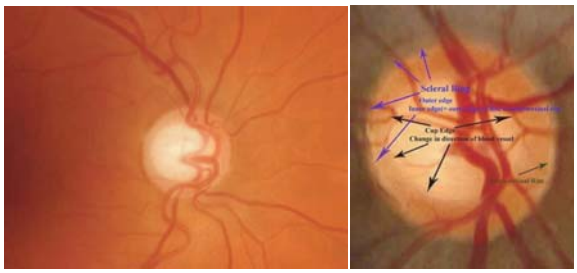
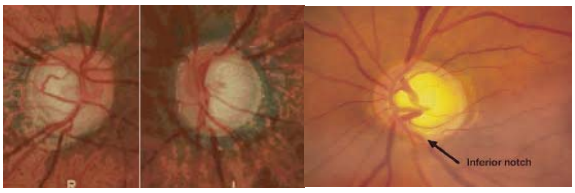
4. Width of NRR



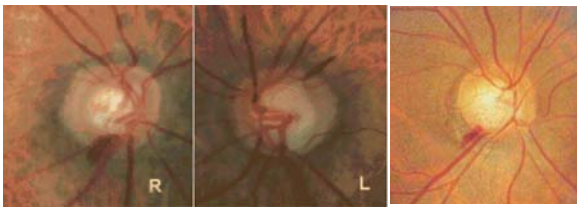
5. Vessel Course



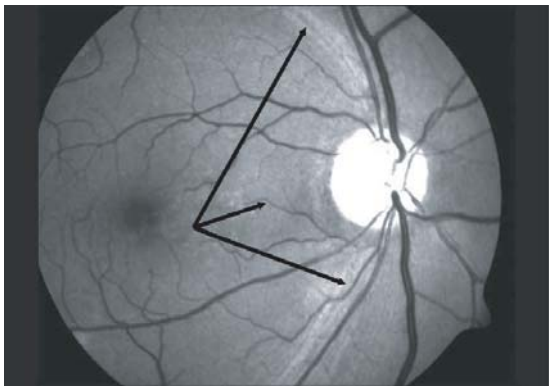
6. Focal atrophy/ Polar notching



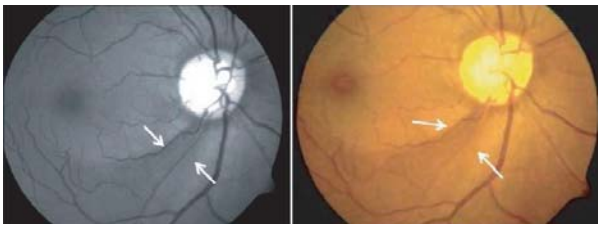
7. Splinter haemorrhage or Drance haemorrhage



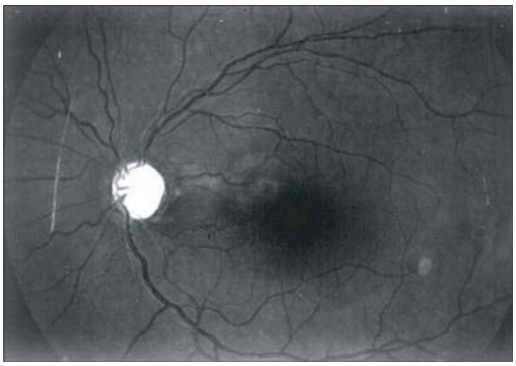
8. Red free optic disc photograph (Normal RNFL pattern)



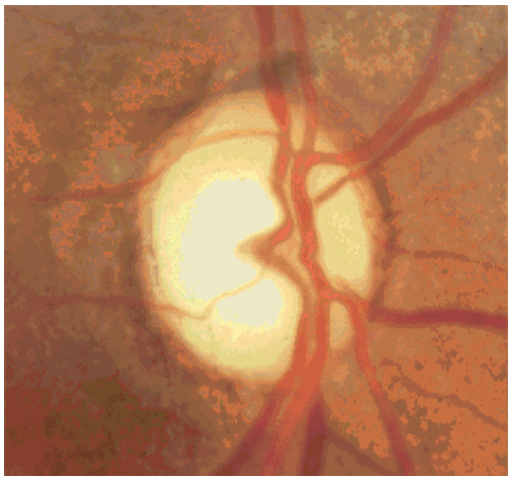
9. Optic photograph showing wedge-shaped defect



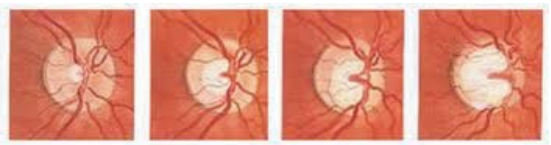
10. Red free photograph showing diffuse nerve fiber layer defects



11. Pallor/Cup discrepancy



12. Progression of optic cupping



Both clinical examination and photographs are part of the standard for glaucoma care.

These nonquantitative methods require subjective physician interpretation and can be difficult and time-consuming in a busy clinical practice.

Usefulness of quantitative imaging devices

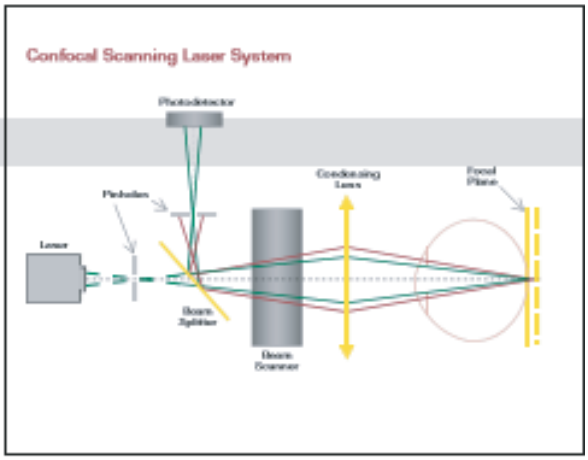
- Early detection,
- More sensitive way to detect glaucomatous progression.
- Complement the assessment of glaucomatous damage.
- Can aid in detecting disease progression.

Quantitative Imaging technologies

- Confocal scanning laser ophthalmoscopy (CSLO)
- Scanning laser polarimetry (SLP)
- Optical coherence tomography (OCT)
- The retinal thickness analyzer (RTA).

Confocal Scanning laser Ophthalmoscopy

- Real-time imaging technique
- Produce three-dimensional images of the ONH.



Optical Principle of CSLO.

The Heidelberg Retina Tomograph II (HRT II)

Latest iteration in the application of confocal scanning laser ophthalmoscopy to the examination of the optic disc.

HRT

HRT in Glaucoma

- Rapid, reproducible topographic measurements of the optic disc.

a. Size of the optic disc

b. The contour and shape of the optic disc.

c. Neuroretinal rim.

d. Optic cup.

e. Measurements of the peripapillary retina.

f. Measurement of nerve fiber layer.

Imaging in HRT

- Operating Steps are

a.The pre-scan

b.Three confocal scans can usually be obtained in under 7 seconds.

c.The individual scans are then stored on the hard drive for later processing.

d.The result produces the reflectance image and the topography image.

d. The result produces the reflectance image and the topography image.

Interpreting The Hrt Printout

- Interpretation of HRT data should be methodical.
- A step-by-step approach to the interpretation of the printout

1.mean topography standard deviation (SD)

a.Located at the bottom of the list of stereometric parameter.

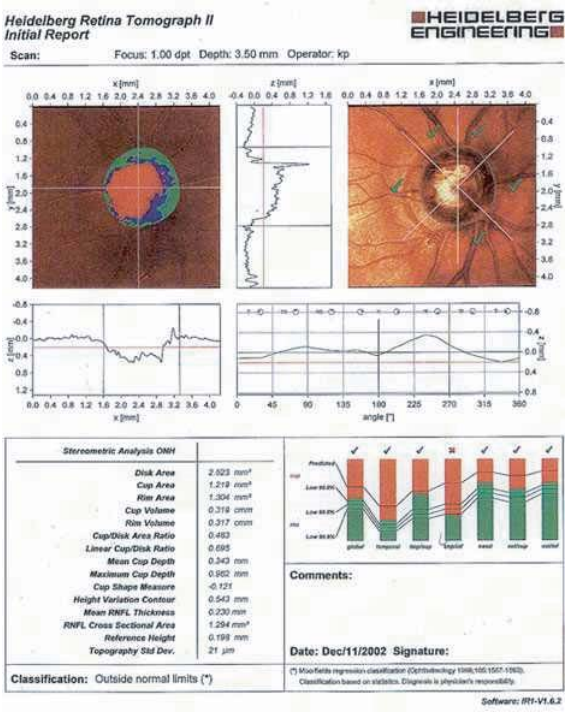
b. It checks image quality.

c. Quality increases as SD value decreases

2. Position of the contour line.

- HRT parameters are calculated based on the location of the contour line
- Results may vary dependent upon its placement

3. Review the left half of the report



- On the topography image, the HRT draws a color-coded map.
- The red area- The Cup
- The blue (sloped) and green (flat) areas - the neuroretinal rim.
- The vertical and horizontal cross-section graphs beside and below the topography image give some idea of the shape of the optic nerve head.
- Next look at the list of stereometric parameters.
- These are more useful at follow-up visits to monitor progression.
- Note the global classification of either normal, borderline, or outside normal limits

4. Review right half of the page

- illustrates a sector classification based upon the Moorfields Regression Analysis.

Moorfields Regression Analysis

The MRA is depicted as seven colour bar graph.

One bar for each segment and one global bar(Right)

- If top of the green bar lies above the 95% prediction interval then the corresponding disc segment is classified as within normal limit
- If it lies between the 95.0% and 99.9% it is outside normal limit

Applications of HRT data in glaucoma management

1. Quantitative measures

- Optic disc size varies among normal subjects, and ranges between 0.80 and 5.54 mm2.
- Compares the results with a normative database.
- Facilitates the identification of physiological from Glaucomatous cup.

2. Detection of damage

- Moorfields Regression Analysis is able to identify structural damage by comparing patient data to a normative database .
- It evaluates the neuroretinal rim area to disc

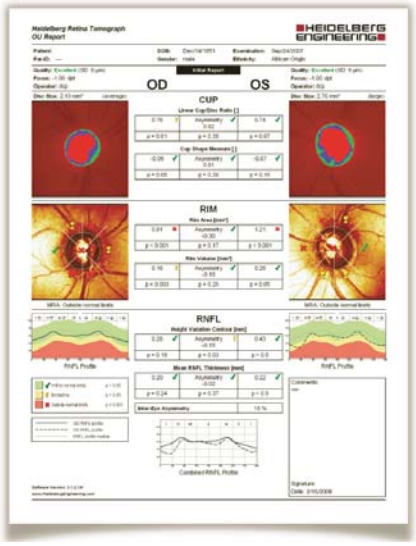
area ratio globally and at each of six sectors.

3. Location of damage

- Sector analysis is useful to locate structural damage of the rim.
- Use the upper right graph (reflectance image with Moorfields Regression Analysis) for this purpose.
- HRT helps to locate and describe axonal loss as focal or diffuse

4. Comparison between Eyes

- It is useful to compare both eyes to interpret clinical findings.



Points to be Noted

- Abnormal HRT results suggest the presence of objective structural damage, but HRT data should never be considered alone.
- HRT results should be assessed as part of a patient's clinical history and examination, and need to be interpreted together with other clinical findings.

Strengths and limitations

Strengths

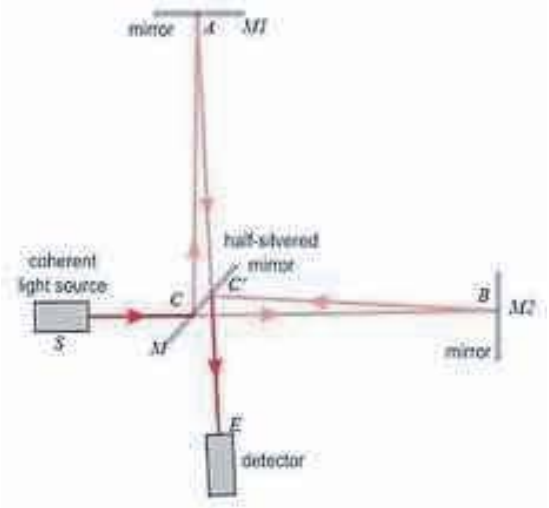
- Rapid simple operation of the device (HRT II)
- Three-dimensional, topographic representation of the ONH
- No pupil dilation necessary
- Advanced data analysis capability built-in to machine

Limitations

- The use of a reference plane is required.
- Manual tracing of the ONH margin must be performed by the operator.
- Measurements may be affected by blood vessels.
- The CSLO method is appropriate for scanning the ONH
- Useful quantitative thickness measurements of RNFL and Macula can not be done.

Optical Coherence Tomograhy In Glaucoma

- Optical coherence tomography is a noncontact noninvasive imaging technology that uses light to create high-resolution, real-time, cross-sectional tomographic images.
- OCT is the optical equivalent of B-scan ultrasonography wherein light reflection from the scanned area is detected.
- The machine can differentiate layers in the retina owing to differences in the time delay of reflections from various components of the tissue
- It is based upon the principle of Michelson's Interferometry.



- The Michelson interferometer is a device that produces interference between two beams of light.

- Light from a light source is split into two parts.
- One part of the light travels a different path length than the other.
- After traversing these different path lengths, the two parts of the light are brought together to interfere with each other.
- The interference pattern can be seen on a screen

OCT- Where Useful in Glaucoma

A. Disc suspect.

B.Ocular hypertension (OHT)

C.Un reliable VF

i. Unable to understand.

ii. Fallacious progression.

iii. Glaucoma with macular pathology.

D. Advanced glaucoma

How does OCT help in Glaucoma

OCT allows

i. Objective measurement of RFNL thickness. (3-4mm diameter circle, centered on OD)

ii. Optic disc parameter.(3 dimensional)

iii. Macular thickness.(Map)

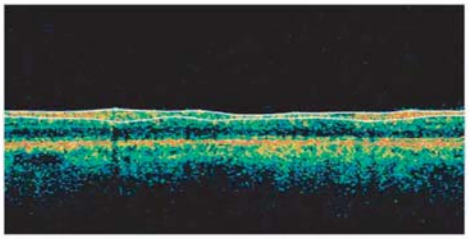
All of which have been used for investigating the glaucoma.

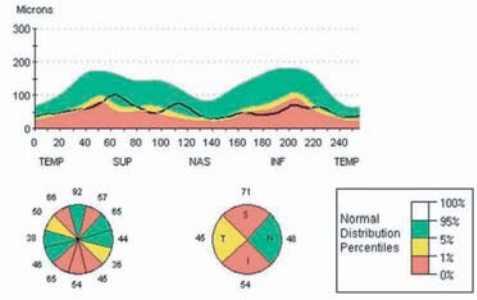
Analysis Protocol For Glaucoma

- RNFL Thickness (Single eye).
- RNFL Thickness Average (OU).
- RNFL Thickness Serial Analysis.(OU)
- Optic Nerve Head(Single eye)
- RNFL Thickness Map(OU)
- Macular Thickness(Tabular)

RNFL Measurement

- RNFL thickness in the inferior region and mean RNFL thickness helps to discriminate healthy eyes from eyes with early to moderate glaucoma.
- The normal RNFL graph appears as "double hump".
- It is due to increased RNFL thickness at the superior and inferior poles of the disc.



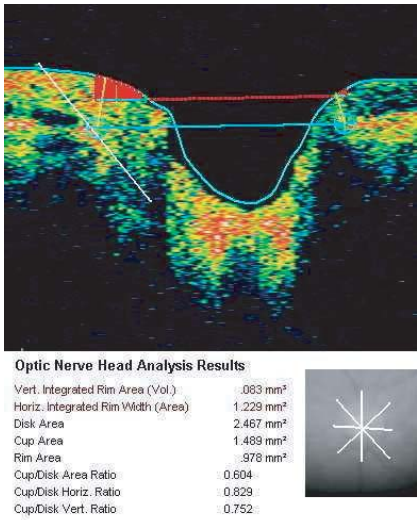


- Output chart also provide RNFL thickness values in clock hours and quadrants.

Optic Nerve Head

This radial scans through the disc provide cross-sectional information on cupping and neuro-retinal rim area.

Disc margins are objectively identified using signal from end of

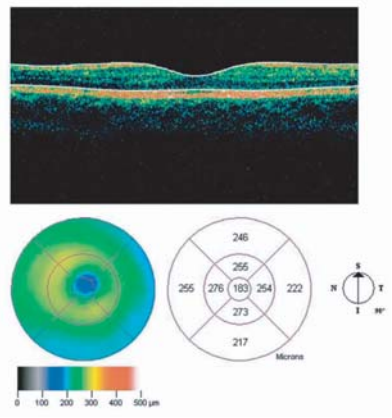


Macular Thickness Map

- There has been recent interest in the role of

OCT macular thickness measurements for glaucoma diagnosis.

- The mean macular thickness of glaucomatous eyes has been shown to be significantly lower than that of normal control eye.
- Consists of series of 6-24 equally spaced line spaced line scanned through a common central axis.



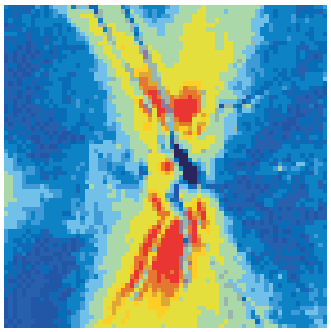
Scanning Laser Polarimetry

Concept of the Instrument

- It is an imaging technology optimized for quantitative measurements of the nerve fiber layer for the detection and evaluation of glaucoma.
- It uses the birefringent properties of the retinal nerve fiber layer to quantify its thickness.
- The parallel arrangement of the microtubules within the retinal ganglion cell axons causes a quantifiable change in the polarization of light that passes through them.
- This change is called retardation, and its numerical value is proportionate to the thickness of the nerve fiber layer.
- The detectors measure the change and convert it into thickness units that are graphically displayed.

SLP assessment of the optic Disc

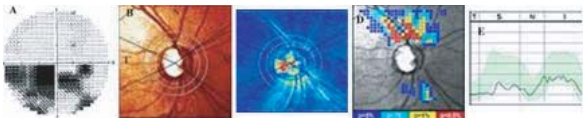
- This system will analyze and give colors for certain various thicknesses.
- Presents RNFL thickness in colour with thick regions in red and yellow and thin regions in blue and green



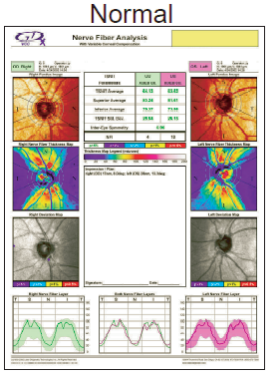
- For healthy eye, the image will show yellow and red colour in superior and inferior at NFL regions.

In glaucoma,

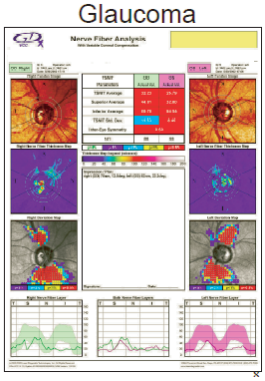
- There is absence of red and yellow colours.
- Superiorly and inferiorly more uniform blue appearance.



Normal



Glaucoma



Conclusion

Various Imaging technology adds information and supports documentation and clinical decisions.

They does not substitute clinical examination or assessment of functional damage.

Improved technology, imaging and computing system shows promises to detect glaucoma at an earlier stage, use in conjunction with clinical examinations, facilitates the patient management decision.

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Ahmed Glaucoma Valve Implantation in Primary Angle Closure Glaucoma (PACG) following Bilateral Combined Surgery – A Case Report

Z Hassan[1], BK Sarker[2], P Musa[3], J Kabir[4], R Sultana[5], T Rhaman[6]

Abstract

Background : The purpose was to evaluate the outcome of Ahmed glaucoma valve (AGV) in Primary Angle Closure Glaucoma (PACG) following failed combined surgery in both eyes.

Methods : A 57 year old lady who had undergone left Trabeculectomy with IOL and laser PI in right eye presented to our institution complaining of discomfort and diminished vision in both eyes despite highest anti glaucoma medication. Examination revealed, the visual acuity was 6/18 and 6/12 with PH in the right eye and FC in the left eye. The intraocular pressures (IOP) were 06mmHg(RE) and 37mmHg(LE) with highest topical anti glaucoma medication. Slit lamp examination revealed clear cornea in both eyes. Goniscopy showed 360 degree angle closure in both eyes. Bleb was flat in left eye. The PI in both eyes were patent and fundus examination showed glaucomatous cupping in both eyes.Surgery was performed by first implanting AGV in left eye. During follow up IOP was well controlled with timolol 0.5% at 13mmHg and vision improved with unaided visual acuity of 6/36 which improved with correction to 6/12 as at last visit.

After few months, Trab with IOL was done in right eye due to raised IOP in spite of laser PI and highest antiglaucoma medication. During follow up IOP was on the increase and at 30mmHg medication was started but not well controlled and glaucomatous cupping occurred. This necessitated a second AGV to be implanted in the right eye and there was no intraoperative or postoperative complication and IOP was within normal. Vision has improved over the last 3 years of follow up. As at last follow up visit, unaided visual acuity was 6/60 and 6/9 with correction. The IOP has remained 11mmHg in the right eye.

Results : Postoperatively patient was followed up for three years. The patient was free from major symptoms except dry eye and mild uveitis controlled by artificial tear and mild steroid eye drops. The IOP is well controlled at 11mmHg in right eye and 13mmHg in left eye with one anti glaucoma in left eye and vision improved by five lines of Snellen's chart and maintained in both eyes.

Conclusion : Though the use of AGV for controlling refractory glaucoma is well known but its use in PACG is scanty. By the report we can conclude that implanting AGV is viable option for controlling IOP up to three years in PACG with failed combined surgery.

Keywords : Angle closure glaucoma, Failed trabeculectomy, Ahmed glaucoma valve ,combined surgery.

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Introduction

Angle-closure refers to the apposition or adhesion of the peripheral iris to the pigmented trabecular meshwork, blocking aqueous access to the filtering meshwork.[1] Chronic angle-closure glaucoma(CACG) is a major causeof blindness, particularly in Asia.[1] The goals of management are to prevent both progression of anatomic angle-closure and progression of glaucomatous optic neuropathy. The definitive initial treatment is laser iridotomy to eliminate the pupil block and laser peripheral iridoplasty is the second-line treatment to eliminate any residual appositional angle-closure. Topical medications are used if the intraocular pressure remains uncontrolled. If the target pressure is not reached with maximally tolerated medications, surgery is indicated. Once glaucomatous optic neuropathy and visual field defect has developed, 94-100% may require further surgical treatment to control the IOP.[2]

Surgical options include trabeculectomy +/- lens traction; lens extraction alone; combined phacoemulsification and non-penetratingdeep sclerectomy; goniosynechialysis with or without

lens extraction; cyclodestructive procedures and glaucoma drainage implants (GDI).[3,4]

Case presentation

The case is that of a 57 years old lady who had undergone a Trab with IOL in left eye and laser PI in right eye who presented to our institution complaining of discomfort and diminished vision in both eyes despite highest anti glaucoma medication. Examination revealed a visual acuity of 6/18 and with PH 6/12 with IOP 06mmHg in the right eye while the left eye had FC (same with PH) with IOP of 37mmHg with topical highest anti glaucoma medication. Slit lamp examination n revealed bilaterally clear cornea, goniscopy showed 360 degree angle closure in both eyes. The bleb was flat in left eye and PI patent in both eyes.Fundus examination showed glaucomatous cupping.

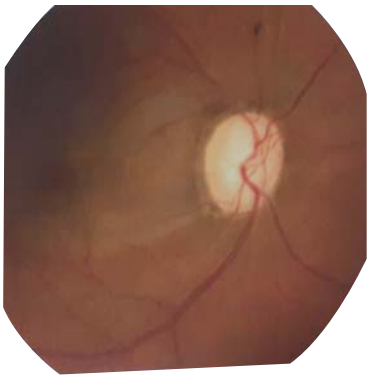

Fig.-1 : Colour fundus photo (RE)

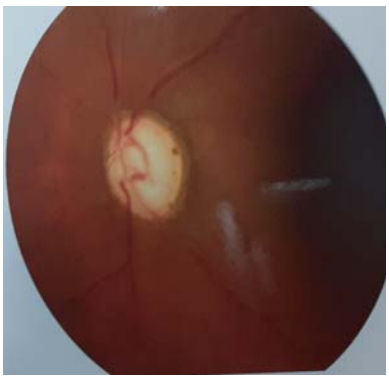

Fig.-2 : Colour fundus photo (LE)

Surgery was performed using peribulbar anaesthesia. AGVs were implanted in the superonasal quadrant in left eye and superotemporal quadrant of upper fornix in right eye.The plate of the valves were secured to the sclera with 9-0 Nylon sutures, 8 mm posterior to the surgical limbus. Both tubes were trimmed bevel up , inserted at 3 mm behind the limbus and placed in the anterior chamber through a 23 gauge needle track. Care was taken to ensure that the bevel of the tubes were not facing the iris and tubewas made 3mm long into the AC to avoid tube corneal touch due to shallow AC. Tubes were anchored to the sclera using 10-0 nylon suture covered with rectangular piece of scleral patch graft. The conjunctiva were closed with 8-0 vicryl sutures and anterior chamber formed.

Postoperatively, she was placed on steroids and antibiotics eye drops and ointment.

After few months, Trab with IOL was done in right eye due to raised IOP in spite of laser PI and highest antiglaucoma medication. During follow up IOP was on the increase and at 30mmHg medication was started but not well controlled and glaucomatous cupping occurred. This necessitated a second AGV to be implanted in the right eye and there was no intraoperative or postoperative complication and IOP was within normal. Vision has improved over the last 3 years of follow up. As at last follow up visit, unaided visual acuity was 6/60 and 6/9 with correction. The IOP has remained 11mmHg in the right eye

Follow up was for 3years and vision improved by five lines of Snellen's chart and maintained in both eyes.

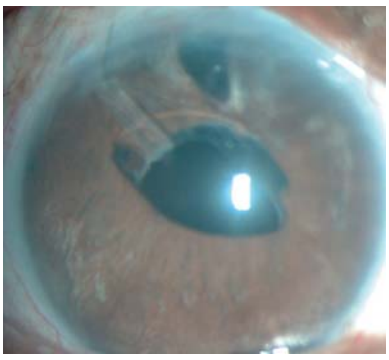

Fig.4 Postoperative picture (RE)

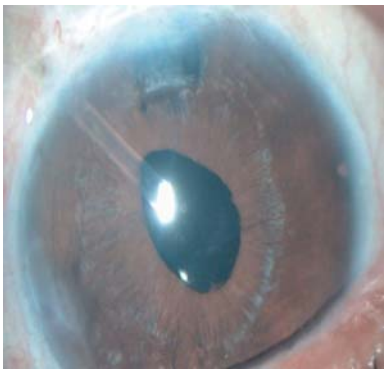

Fig.-5 Postoperative picture LE

Discussion

There is scanty report on the use of AGV in angle closure glaucoma. Our case has shown that Ahmed Glaucoma Valve is effective in IOP control in patients with CACG. In this index case, despite the previous laser peripheral iridotomy and Trab with IOL and antiglaucoma medications the IOP was not controlled. Trabeculectomy is effective for CACG.[3,4] but associated with a higher risk of filtration failure, shallow anterior chamberand malignant glaucoma than for primary open-angle glaucoma[5,6]Trabeculectomy alone is not the ideal surgical option for medically uncontrolled CACG due to increase rate of cataract progression and future cataract surgery may result in loss of the functioning filteration.[1] The use of GDI has its potentially serious complications and so reserved for CACG patients for whom one or more previous filtering procedures have failed. The complications encountered in our case were shallow AC and hypotony which was managed appropriately. Gedde S.J et al in their 1year follow up period found a higher success rate in the implant group than in the trabeculectomy group.[7]

Conclusion

The use of AGV is well known for controlling IOP in refractory glaucoma. However its use in ACG is scanty. By this report we conclude that AGV is a viable option for longstanding ACG not responding to conventional treatment.

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Adverse situation management of a case of Unilateral Pseudoexfoliative glaucoma

Z. S. Shahid[1], H. U. Rashid[2], M. H. Rahman[3]

Abstract

IOP can be reduced through different means. Each should be properly discussed with the patients to have their co operation. We report a case of unilateral pseudoexfoliative glaucoma, treated for years with triple topical ocular hypotensive drug.

The patient presented with advanced optic neuropathy and important ocular side effects secondary to the treatment. Having discussed regarding options and prognosis, Selective laser trabeculoplasty was performed while maintaining the remaining therapy considering the advanced stage of glaucoma. Her IOP was effectively reduced and no progression was noted after 1-year follow-up. Although medical therapy is the mainstream in glaucoma management, its side effects should not be ignored, especially in unilateral cases. Surgery might have been a better solution, but we chose to perform laser trabeculoplasty, an effective and safer alternative, considering the unlikely but serious risk of the "wipe-out phenomenon" in this case.

Background

Optic neuropathy due to glaucoma is the most commonly acquired optic neuropathy and a leading cause of blindness. Its prevalence varies widely: Primary open-angle glaucoma (POAG) is believed to affect between 1.1% - 2.1% of whites aged 40 years and older, with a higher prevalence in some ethnic groups such as African Americans who are three times more sufferer from it and at least four times more likely to become blind by it, while primary angle-closure glaucoma affects around 0.1% of white populations in Europe and the USA.[1] Secondary open-angle or angle-closure glaucoma may be caused by a variety of different pathologies and it is hard to estimate their prevalence.Glaucoma Prevalence is relatively high in Bangladesh, above 40 years POAG is 2.5%, PACG & secondary glaucoma is 0.4% & 0.2% respectively[16].

Several risk factors increases the riskof developing glaucoma, but high intraocular pressure (IOP) remains the most important.[1–4] IOP can be lowered by : medical, laser therapy or surgery. Most patients are treated medically with topical eye drops or gels, with a number of available agents to choose from: β-blockers, prostaglandins analogues, carbonic anhydrase inhibitors and others. Most drugs are relatively well tolerated, but there are some important side effects of these medications, not only ocular but also systemic. Due to chronic use of drug many patients presents with ocular tear film abnormality, lack of ocular surface integrity along with discomfort, burning, ulceration, scarring.

A relatively common cause of chronic open-angle glaucoma is the Pseudoexfoliative (PXF) syndrome, or Pseudoexfoliative glaucoma (PXG), 15–20% of all open-angle glaucoma diagnosis.[2] It tends to be more frequent in women aged over 50, prevalence between 0.6% (age 52–64) and 5% (age 75–85).[2]

It is thought to be an ocular manifestation of a systemic disease, characterized by deposition of a grayish white fibrillar extracellular material produced by abnormal basement membranes of ageing epithelial cells.[1–4] on the trabecular meshwork and other structures of the anterior segment. Classically it leads to unilateral glaucoma, but the 'uninvolved' eye most likely has subclinical PXF syndrome, so it called asymmetrical disease.[2] It has a higher incidence of failure by medical therapy.[5 6] refer for laser or surgery more often. Unilateral or asymmetric disease and poorer response to medical

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treatment PXG may sometimes become difficult to manage in some cases, making us weigh the potential side effects of prescribing eye drops only for one eye (often in associations and for a long period of time) versus the risk of disease progression or more invasive treatment modalities, namely surgery. Laser trabeculoplasty may, be a powerful adjunct in the treatment of many patients with PXG, making it possible in some cases to lower the medical therapy or even avoid the risks of surgery.

Case presentation

A diagnosed case of glaucoma a 56 years female patient, with no relevant medical history, presented to Deen Md Eye Hospital and Reserch, in April 2019. She had been followed in a private setting by another doctor for many years who had prescribed two different eye drops for his right eye: PG analogue & a combination of a brimonidine and brinzolamide. The patient experienced some burning and foreign body sensation since she started the medication. But her doctor did no treatment of her left eye and did not prescribed any other eye drops for right eye. She also referred non-complicated cataract surgery by phacoemulsification with PC IOL in the right eye 6 m earlier due to diminished visual acuity (VA).

On examination, her best corrected VA was 6/6 P in R/E & 6/6 in L/E. There was an obvious difference in her eyelashes' length. The patient was concerned about the pigmentary changes arround the eye but decided to continue the prescribed drugs.

On slit-lamp examination, a decrease in tear meniscus height as well as in break-up time (<5sec) was noticed, on her right eye upon fluorescein instillation, which also revealed a punctate keratitis on the cornea's lower one-third (Fig: 1). Pseudophakic status was confirmed on the right, with a posterior chamber intraocular lens well centred and with no posterior capsular opacification. A careful look at the pupillary margin revealed "moth-eaten" transillumination defects and deposition of a greyish material, which is absent on her left eye, suggestive of PSX. Her IOP was 24 mm Hg on the right and 14 mm Hg on the left. According to the Spaeth grading system, gonioscopy (Fig. 2)) revealed, in her right eye, an open anterior chamber angle (approximately 60), with a deep iris insertion and a clearly visible ciliary body, a regular peripheral iris and moderate pigmentation of the trabecular meshwork (most marked inferiorly) with an accompanying Sampaolesi line. Gonioscopy findings were similar in her left eye, although the angle was somewhat narrower (due to phakic status) and less pigmented. Fundus examination confirmed a generalised compromise of the neuroretinal rim in her right eye, with a diffuse concentric enlargement of the cup (estimated cup-disk ratio of (0.8),thin sup and inferior suggestive of advanced glaucoma (figure 5); her left eye was unremarkable, with a healthy-looking optic nerve head.

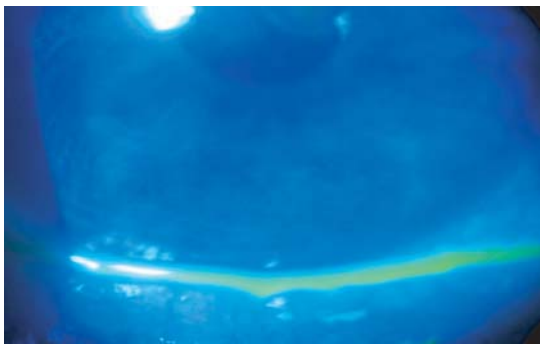

Fig. 1 : Punctate keratitis. Slit-lamp examination with fluorescein showing punctate keratitis on the cornea's lower one-third in the right eye.

Fig. 2 : Slit-lamp examination showing transillumination defects and deposition of pseudoexfoliative material in the pupillary margin (right eye).

Fig. 3 : Gonioscopy using Goldmann three-mirror lens. Gonioscopic appearance of the anterior chamber angle (right eye): open anterior chamber angle (approximately 60°), with a deep iris insertion with the ciliary body clearly visible, a regular peripheral iris and moderate pigmentation (+3) of the trabecular meshwork, with an accompanying Sampaolesi line.

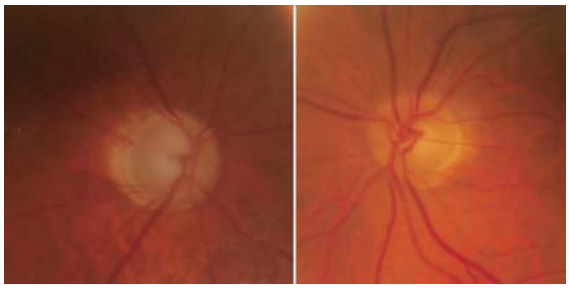

Fig. 4 : Optic nerve head appearance. Retinography detailing the optic discs. Right eye: diffuse compromise of the neuroretinal rim with a cup-disc ratio of 0.8. Left eye: normal looking disc.

Investigations

Time-domain optical coherence tomography, to assess disc morphology and peripapillary retinal nerve fibre layer (RNFL) thickness, and automated static perimetry (using Octopus Perimeter), for visual field (VF) testing, were requested to evaluate glaucoma severity.

In the right eye OCT revealed a generalised decrease in the RNFL thickness and a disc morphology

(Fig :5) compatible with the fundoscopic findings (Fig: 4).

Perimetry showed severe changes of the VF with a mean deviation of 20.6 dB compatible with advanced unilateral glaucoma with a small island of central vision accompanied by a temporal island (Fig : 6).

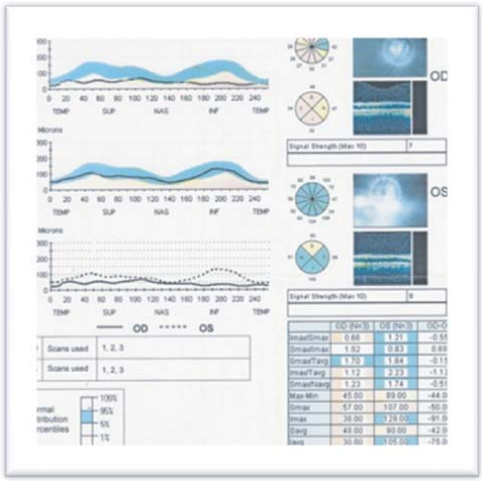

Fig. 5 : Retinal nerve fibre (RNF) evaluation by optical coherence tomography (OCT). OCT revealed in the right eye an important diffuse reduction of the RNF thickness compared to the left eye, with an average thickness of 39.48 and 78.41 µm, respectively

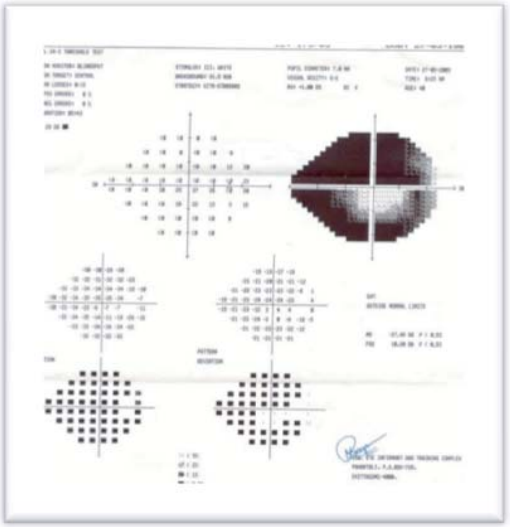

Fig 6 : Visual field (VF) assessment by the HVF (right eye) , showing severe changes with a mean deviation of 20.6 dB compatible with advanced glaucoma with only a small island of central vision accompanied by a temporal island remaining..Left eye no significant change.

Summary

In summary, the patient presented with unilateral PXG in an advanced stage, for which she was being treated with three different topical IOP-lowering agents. Despite this approach, her IOP was far from being controlled (24 mm Hg) and she also presented with some important side effects namely heterochromia and keratitis.

Treatment

After discussing her treatment options, and fearing losing her remaining vision with surgery, we decided to perform Selective laser trabeculoplasty (SLT) in the right eye, around 50 spots (with a spot size of 400 µm, energy 0.6 – 1.2 m. zole 0.1 s duration, aimed at the junction of the pigmented lower 180 trabecular meshwork. No complications were registered; prophylactic Timolol maleate (0.5%) was instilled before and after the procedure to avoid early post laser IOP rise and a short course of topical fluorometholone was also prescribed to treat laser-induced inflammation.

Outcome and follow-up

Owing to the glaucoma severity, we decided to maintain the current medical therapy. Lubricants were added, however, to treat the keratitis which resolved with success, leading to a significant symptomatic improvement. Her post laser IOP ranged from 12-15 mm Hg and no deterioration was seen in her OCTs and VF after a follow-up of 1 year.

Discussion

The reported case is a clear example of how glaucoma (or any other) treatment must be thoroughly planned and balanced. Although the patient's complete previous medical and ocular history was unavailable, making it impossible to have a clear idea of the disease progression, it is fair to say that it was not under good control despite triple therapy, prescribed for some years now. In fact, it was advanced with large cupping of the disc and only a small island of central vision with accompanying temporal island remaining.

It is well known that PXG has a worse prognosis than POAG, often showing rapid progression and poor response to medical therapy.[1–6] In most patients, this makes using more than one IOP-lowering drug avoidable. Many cases of PXG are also unilateral, at least at the time of diagnosis (although 25% of patients develop PXF signs in the fellow eye within 10 years)[2] such as in the reported case, which makes therapy decisions even harder. So how should we treat these patients?

β-Blockers are an excellent first-line therapy option, although most need to be used twice a day and have potential systemic side effects that have to be taken into account PG analogues are another good choice, with a once-daily dosing regimen that may be easier for patients to follow and fewer systemic adverse events, but with important potential secondary ocular changes[1–4 7 8] such as eyelash lengthening, thickening and hyperpigmentation and irreversible iris hyperpigmentation (in 11–23% of patients in 6 months)[3] which can obviously lead to heterochromia when one eye is not under treatment. Both drug classes (and their associated excipients) can also lead to ocular surface dysfunction, decreasing aqueous tear secretion (β-blockers), causing corneal staining,[9] inducing inflammation[10] and causing symptoms such as foreign body or burning sensation and hyperaemia, all of which can be a concern to patients' compliance. α-2 Agonists, topical carbonic anhydrase inhibitors and other now less commonly used drugs (namely miotics—which are, however, associated with an increased risk of induced angle-closure and development of posterior synechiae in PXG[2]) are also available, but are usually used as second-line therapy options.

Another problem which needs to be taken into account when discussing glaucoma therapy is the surgery failure related to chronic exposure to preservatives present in many of these eye drops. In fact, considering surgery as an "if all else fails" option may not be the wisest choice; earlier, better IOP control may possibly be achieved with trabeculectomy (and probably other surgical approaches), preventing glaucoma progression while avoiding years of ocular exposure to eye drops, which can ultimately make the surgery harder and reduce its success rate.[1–4 11 12] This is even more worrying in patients with advanced glaucoma whose options are running out and who cannot afford having uncontrolled IOP for much longer and be

submitted to repeated invasive procedures in an attempt to lower it. Only by knowing our patient's full previous history could we discuss the possible best course of action; maybe an earlier surgery could have delayed the disease progression and avoided most mentioned side effects thus decreasing risk of failure if surgery became clearly necessary.

Although recent data seem not to support the traditional idea of "wipe-out phenomenon" with sudden visual loss following surgery in end-stage glaucoma (which can occur in approximately 6% of these cases),[13–15] due to the patient's concern of losing her remaining vision we decided to perform laser hoping to lower her IOP to more acceptable values and slow down her progression. We appear to have been successful in doing so (at least with a 1-year follow-up), although only time will tell if the laser effect is long-lasting and sufficient enough or not. Published data,[1–4] unfortunately, tells us that in resemblance to what happens with topical therapy, laser trabeculoplasty also presents higher failure rates in PXG than in POAG. Retreatment is, nevertheless, an option (especially since we only treated the lower 180°), and a safe one.

In conclusion, glaucoma remains one of the most important and usually preventable or more easily manageable causes of blindness worldwide. Thankfully, every day new advances in its therapy are registered, contributing to the healthcare and quality of life of these patients. Topical IOP-lowering agents are still the mainstay of glaucoma treatment and efficient in most cases in preventing its progression, and are usually well tolerated. One must not forget, however, that this is a chronic therapy and although probably surpassed by their benefits, all of these drugs have some side effects which should not be disregarded. Ocular surface integrity is essential to the eye's normal physiology and health and its compromise is a well-known cause of potential serious diseases and many discomforting symptoms, which in turn may lead to poor patient compliance and ultimately glaucoma progression. Hence our responsibility in choosing the best treatment options for our patients and not overlooking what may seem "minor" and "acceptable" adverse effects. Laser treatments such as trabeculoplasty, available and easily performed by most ophthalmologists, stand as good adjunct therapies, in some cases making it possible to avoid multiple topical agents while also being safer than surgery.

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Choroidal Effusion with Exudative Retinal Detachment Following Ahmed Valve Implant in Sturge Weber Syndrome - A Case Report

MZ Hassan[1], J Kabir[2], BD Sarker[3], GEH Akpu[4], S Manjur[5], TR Chara[6], S Alam[7]

Abstract

Background : Ahmed glaucoma valve implant appears to be a relatively useful drainage device in eyes with Sturge Weber Glaucoma, however early postoperative choroidal detachment can occur from a rapid expansion of the choroidal hemangioma with effusion of fluid into the supra choroidaland subretinal spaces. Surgeon needs to anticipate and reduce sudden hypotony during surgery. This report describes our clinical experience with the Ahmed Glaucoma Valve implant in Sturge-weber glaucoma in a 10- year old boy that was refractory to conventional medical and surgical treatment. In our case, choriodal detachment and exudative retinal detachment occurred postoperatively. Patient responded to conservative management and sclerotomy was not required.

Key words : Ahmed glaucoma valve, Sturge-Weber syndrome, choroidal hemangioma, Choriodal detachment

Introduction

Sturge-Weber glaucoma is present when the facial hemangioma involves the lids or conjunctiva.[1]The onset of glaucoma may present from infancy to early adulthood. In older children, the elevated IOP is due to an elevation of episcleral venous pressure that occurs as a result of arteriovenous shunts through the episcleral hemangiomas.[2,3]

Choroidal hemangiomas and episcleral hemangiomas are commonly seen, and leakage from the choroidal hemangioma may cause retinal edema. In approximately 20% of procedures which penetrate the anterior chamber, intraoperative or early postoperative choroidal detachment can occur from a rapid expansion of the choroidal hemangioma with effusion of fluid into the suprachoroidal and subretinal spaces[4]

In older children, medical therapy may be better tolerated and effective, with fewer side effects. If medical therapy is unsuccessful,filtration surgery can be used. However, the results of trabeculectomy without anti-metabolites are poor,[5,6] but adjunctive anti-metabolites can cause postoperative hypotony and other risks.[7,8] Hence the Ahmed Glaucoma Valve implant with a unidirectional valve that is designed to open at a pressure of 8 mm Hg, potentially decreasing the risk of postoperative hypotony may be a better surgical option for recalcitrant glaucoma in patients with Sturge-weber syndrome.

This report describes our clinical experience with the Ahmed Glaucoma Valve implant in Sturge-weber glaucoma that was refractory to conventional medical and surgical treatment.

Case Presentation

A 10-year old male child with Sturge Weber Syndrome(SWS) and glaucoma presented to the glaucoma department with raised intraocular pressure(IOP) in the left eye. He had undergone trabeculectomy in the right eye with mitomycin C before presentation. On Examination, his best corrected Visual acuity on the right eye was 6/6 and on the left was 6/9. His Intraocular pressure was 15mmHg on the right eye and 37mmHg on the left eye.

Slitlamp examination of the right eye was within normal limit while that of the left eye showed a diffuse superior bleb with a patent superior peripheral iridectomy. Cornea was clear and peripheral anterior chamber depth was equal to cornea thickness.

Fundoscopy revealed a cup disc ratio of 0.7 and was comfirmed with aColour fundus photograph

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(fig1a). B-scan ultrasonography revealed a diffuse choroidal hemangioma with no choroidal neovascularization or exudative detachment seen in the left eye(fig 1b).

Patient was placed on anti glaucomamedications (cosopt) eight hourly, travast once daily at night and acemox tablets 125mg twice daily for fifteen days. Follow up of this patient revealed progression of optic nerve damage and persistently raised intraocular pressure of 23mmHg despite antiglaucoma medication.

He underwent Ahmed glaucoma valve implantation in the left eye under general anaesthesia.

Post-operatively patient was placed on antibiotics (optimox) four hourly daily, steroid (cortan) two hourly daily, homatropine eight hourly daily, and steroid ointment (sonexa) at night. On the first postoperative day, the visual acuity was 3/60, the anterior chamber was shallow with choroidal detachment and exudative retinal detarchment.(fig 2a and 2b) Patient was then placed on conservative management.

On the fifth postoperativeday, visual acuity improved to 6/60, slitlamp examination showed a peripheral anterior chamber depth of ½ central corneal thickness. Intraocular pressure was 9mmHg. Patient was continued on post - operative medications and follow up visits. Subsequent visit at one month postoperatively revealed visual acuity of 6/24 and intraocular pressure of 12mmHg. B-scan ultrasonography showed no choroidal effusion and no serous retinal detarchment. (fig 3)

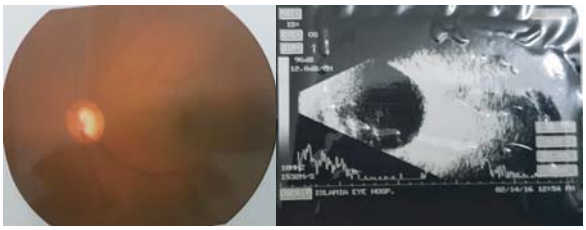

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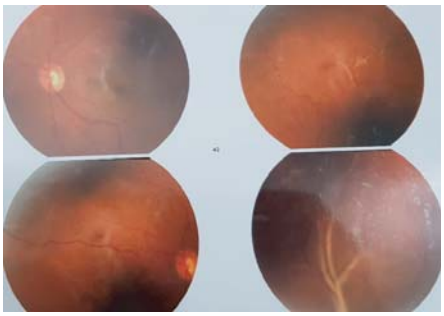
Figure 1 : (a) Fundus photograph showedno choroidal neovascularization or exudative detachment. (b)B-scan ultrasonographyrevealed a diffuse choridalhemangioma with no choroidal neovascularization or exudative detachment.



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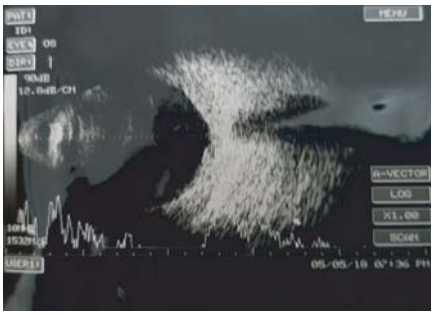

b

Figure 2 : (a) Postoperative fundus photograph showing choroidal neovascularization or exudative detarchment. (b) postoperative B-scan ultrasonographyrevealed a diffuse choroidalhemangioma with choroidal neovascularization or exudative detachment.

Figure 3 : B-scan ultrasonography showed no choroidal effusion and no serous retinal detarchment at one month postoperative period.

Discussion

Our study shows that Ahmed glaucoma valve is effective in the control of intraocular pressure in patients with Sturge-weber glaucoma. Previous studies have equally demonstrated the efficacy of Ahmmed valve implant in patients with sturge-weber glaucoma.[1,9] The major surgical concern in this case was the presence of a diffuse choroidal hemangioma.There is a higher risk of massive haemorrhage with a fragile choroidal hemangioma during surgery.

The best surgical modality would be one that produces the leasthypotony during the procedure. Patients withSWS receiving Ahmed glaucoma valve implantation still have the potential of developing sight-threatening complications of choroidal effusion and haemorrhage when IOP suddenly decreases.[10,11,12,13]

In our index case ,patient hadchoroidal effusion and retinal detarchment, which responded to conservative management.

Previous studies reported complication of choroidal detachment following Ahmed glaucoma valve.[(14,15)] Another study had no complication like in our study.[(1)] This may be because Ahmed glaucoma valve was primarily implanted in the latter while in the former studies there was a previous history of glaucoma surgeries. Our patient also had a previous history of trabeculectomy before receiving Ahmed glaucoma valve. Ligatation of the valved glaucoma drainage implants, as is done for the non valved implants hasbeen suggested. Oral propanalol has also recently been used to treat patients with diffuse choroidal haemangioma prior to glaucoma surgery.[15]

Conclusion

Ahmed glaucoma valve offers safety and efficacy in controlling glaucoma in pediatric Sturge-Weber syndrome with choroidal hemangioma. However surgeons should anticipate and prevent sudden hypotony.

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Traumatic angle recession with secondary glaucoma- an iceberg in the sea, a case series study

S M Noman[1]

Abstract

Purpose : To describe the patterns of outcomes and management approaches to patients diagnosed with angle recession glaucoma presenting at the Glaucoma Department, Chittagong Eye Infirmary & Training Complex, Bangladesh.

Design : A hospital-based prospective observational case series review.

Participants : 25 patients who were diagnosed with angle recession glaucoma over a 1 year period from November 1st 2009 to October 31st 2011.

Method : Patient particulars, history and mechanism of trauma were recorded. Ophthalmic examination details (including gonioscopy, intraocular pressure and fundoscopy) and management given were documented. Similar relevant details were recorded for three follow-up periods, on all patients, extending over a total period of 9 months.

Results : 25 patients with angle recession glaucoma were included in the study. Twenty-two of the patients were male. The mean age of patients was 34.9 ± 20.84 years (Range: 9 – 72 yrs). All patients had an angle cleavage of more than 180 degrees, with 68% having a recession of 360 degrees. 56% had a history of hyphaema. In 88% of patients, the intra-ocular pressure (IOP) was controlled and kept at a stable level (< 21mmHg) over follow-up. Of these, 91% were controlled by conservative treatment (topical anti-glaucoma drugs or observation) and 9% was controlled after cataract surgery. Patients with uncontrolled IOP (12%) were advised for filtration surgery. The mean IOP at time of diagnosis was 29.8 ± 9.7mmHg (Range: 14 – 50mmHg). The mean IOP at last follow-up was 18.4 ± 8.4mmHg (Range: 10 – 50mmHg). Visual Acuity (VA) for 23 patients (92%) either remained stable or improved.

Conclusion : Angle recession glaucoma can cause further loss of vision in ocular trauma patients who may already have compromised vision due to injury. Control of IOP and preservation of presenting VA was seen in most cases with conservative management with topical medications and sustained follow-up. Patients sustaining blunt ocular trauma, especially those associated with hyphaema, should be advised for future follow up and have gonioscopic evaluation of the angle.

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Introduction

One of the long-term effects of eye injuries is the development of angle recession and subsequently Angle Recession Glaucoma (ARG). 60 – 94% of patients who have suffered blunt ocular injury have some degree of either angle recession or trabecular membrane damage.[1,2,3] The prevalence of people with angle recession was shown to be 5.5% from a study done in South Africa.[4] Another study in the Cameroon[5] showed a prevalence of post-traumatic glaucoma, related to irido-corneal angle injuries, to be 2.1%. In a study done in India,[6] at an urban referral centre, shows a prevalence of 34 per 1000 glaucoma cases.

4 – 9% of patients with angle recession greater than 180 degrees eventually develop glaucoma.[1,2,7-9] Even though the condition is referred to as "angle recession" (i.e the splitting of the circular and longitudinal muscles of the ciliary body), the real pathology behind the development of raised IOP is not the cleavage in itself. Wolf and Zimmerman[10] suggested that the recession is only evidence of past trauma and not the cause of the glaucoma in itself. It was suggested that initial trauma to the trabecular meshwork stimulated proliferative or degenerative changes in the trabecular tissue, which led to the obstruction of aqueous flow. Herschler[11] supported this concept. Other mechanisms for delayed IOP elevation, in addition to alterations within the trabecular meshwork, include the extension of an endothelial layer with a descemet-like membrane from the corner over the angle.[10]

So despite some injury patients being able to

salvage some amount of functionable vision after injury repair and rehabilitation, they are still susceptible to further visual loss due to ARG (secondary damage). Thus, treatment of a patient with a history of ocular trauma does not end with the initial management of acute complications due to the injury itself. As seen, various mechanisms can lead to ocular hypertension and eventually optic nerve damage leading to glaucoma and, in severe cases, blindness.

ARG is usually managed in a step-wise manner. First medically and then via laser therapy.[12] Patients may not initially respond well to standard medical therapy and management options may usually lead to surgical procedures.[13] When medical and laser therapies have failed, an incisional outflow operation is usually indicated, such as trabeculectomy with mitomycin C[14-16] or valve implantation.

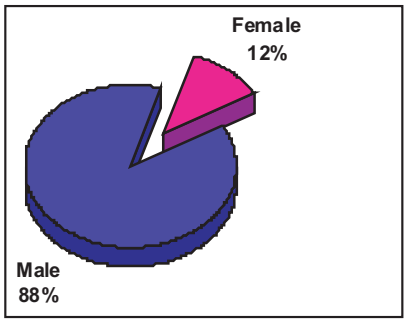

Figure 1 : Gender Distribution of patients

This study was done at the Chittagong Eye Infirmary and Training Complex (CEITC), one of the largest tertiary level ophthalmic centre in Bangladesh. It is the purpose of this study is to document and analyse the various patterns of outcomes and management approaches to patients diagnosed with ARG.

Method

This was a hospital-based combined non-concurrent and concurrent prospective cohort study of all cases presenting to the Glaucoma Department with a diagnosis of ARG. Cases were identified throughout a one year period from November 1st 2009 to October 31st 2011.

All patients were reviewed by a single consultant who took the history and necessary ophthalmic examination.

Details of history included the biographical details of patients (age, gender, address etc); history and mechanism of trauma. Ophthalmic examination was done on patients and examination details included visual acuity (VA); intra-ocular pressure (IOP) measurement by Goldmann Applanation Tonometer; gonioscopic findings by Goldmann 2-mirror contact goniolens; fundoscopic findings and any other notable ocular findings. The method of management was recorded. Diagnosis of ARG was done based on a combination of history, gonioscopic findings, fundoscopic findings and IOP readings.

For previously diagnosed patients, their medical records were retrieved and relevant data were extracted and asked to come for follow-up as necessary. Newly diagnosed patients were duly processed and asked to return for future follow-up visits. At least three follow-up data were recorded, 1 month after diagnosis of ARG, then 3 months and 6 months. On all visits ophthalmic examination was done by the same consultant.

After collection of data, they were then tabulated and analysed. Outcomes of management was assessed mainly with regards to IOP control. Statistical analysis was done using SPSS v.13.

Results

A total number of 25 patients with ARG were encountered during the study period. The total number of eyes affected was 25. Of these, 14 (56%) were newly diagnosed cases and 11 (44%) were previously diagnosed patients.

Table 1: Gender Distribution of patients in the defined Age Categories (p <0.4)

		Gender		
		Male	Female	Total
Age Groups	0 - 19 years	6	2	8 (32%)
	20 - 39 years	5	1	6 (24%)
	40 - 59 years	6	0	6 (24%)
	60 - 79 years	5	0	5 (20%)
	Total	**22**	**3**	**25 (100%)**

22 (88%) of the patients were male and 3 (12%) were female (Figure 1). The mean age of patients was 34.9 ± 20.84 years, ranging from 9 years to 72 years. With regards to the age group of patients, 8 patients (32%) were in the 0 – 19 years category and 5 patients (20%) in the 60 – 79 years category. In all age group categories males were more than females (Table 1, p<0.4).

Degree of Angle Cleavage	Number	Percent	Cumm. Percent
360 degrees	17	68%	68%
270 degrees	4	16%	84%
180 degrees	4	16%	100%
TOTAL	**25**	**100%**	**100%**

All of our patients had an angle cleavage of more than 180 degrees, with 84% having an angle of recession more than 270 degrees and 17 patients (68%) having a degree of angle recession of 360 degrees. (Table 2)

14 patients (56%) had a history of hyphaema at the time of injury, whilst 8 patients (32%) had associated traumatic cataract. Other associated clinical findings included lens subluxation, sphincter rupture, macula hole and choroidal rupture. 56% had a history of trauma 1 year to 5 years prior. 28% had history of trauma occurring less than 1 year ago. In 22 patients (88%), the IOP was controlled and kept at a stable level (<21mmHg) over the follow-up periods and in 3 patients (12%) the IOP was not controlled (even after the use of three-drug anti-glaucoma topical therapy). The mean IOP at time of diagnosis of Angle Recession Glaucoma was 29.8 ± 9.7mmHg (Range: 14 – 50mmHg). The mean IOP at last follow-up was 18.4 ± 8.4mmHg (Range: 10 – 50mmHg).

Of the 22 patients whose IOP were controlled, 20 (91%) were controlled by conservative treatment (use of single or dual topical anti-glaucoma drugs or by observation). The remaining 2 patients (9%) had surgical intervention (Small Incision Cataract Surgery in both cases). Patients with uncontrolled IOP (12%) were advised for filtration surgery (Figure 2).

The VA for 23 patients (92%) either remained stable or improved, in 2 (8%) patients the VA worsened. The last recorded VA of patients in the follow-up showed 7 patients (28%) having a VA of 6/18 and better, whilst 13 patients (52%) had a VA ranging from 6/24 to 3/60. 5 patients (20%) had a VA of CF at ½m and worse.

Discussion

The effects of the injury itself on the eye can be very devastating (i.e primary damage due to the injury). It is estimated globally, that 1.6 million cases of blindness are caused by eye injuries and a further 2.3 million cases with low vision are caused by eye injuries.[17] Approximately 19 million cases of monocular blindness are estimated to be due to eye injuries.[17] According to a report by Thylefors,[18] particularly in developing countries (like Bangladesh), trauma is often the most important cause of unilateral loss of vision (as much as 5% of all blindness). It further states that males tend to have more eye trauma than females and that lower socioeconomic classes are more associated with ocular trauma.

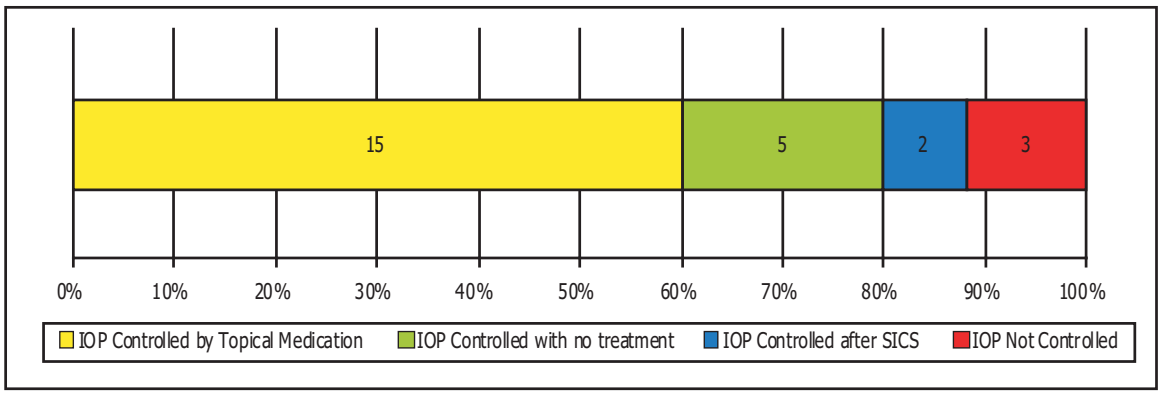

Figure 2 : Management approach for the control of IOP

Despite some amount of initial loss of vision sustained by the patient (whether due to traumatic corneal scarring, or choroidal rupture etc), they are susceptible to further loss of vision due to ARG. In literature and studies it has been shown that ARG can develop as soon as within years, or even decades after the trauma. One study showed mean duration of 16 years;[11] one done in South Africa showed a latency period of 7.6 ± 9.5 years;[14] whilst a study in Cameroon showed a shorter period of 3.7 yrs.[5] Thus, patients who sustain ocular injuries need to be assessed indefinitely to preserve whatever remaining visual function they have to prevent secondary damage. Our study showed majority of our patients (56%) with a latency period within the range of 1 year to 5 years. These findings, along with those of other studies, show that we cannot define a specific time period of the development of ARG, thus reinforcing the need for life-long follow-up of trauma patients.

ARG is expected to be more common in males[4,19] due to the fact that males are more predisposed to have ocular injuries in general (an accepted global pattern showed by many international studies in developing and developed countries).[20-25] This trend is in keeping with those found in our study which showed that 88% of our patients were male (Figure 1) and that the male to female ratio in all age groups was consistently higher (Table 1).

The mean age of our patients was 34.9 ± 20.84 years with a wide range from 9 years to 72 years. A similar wide range was seen in a study in the Cameroon [5] (with a range of 17 to 67; Mean 45.9 ± 18.3 years). Though advanced age is associated with ARG, in our study 8 patients (32%) were in the 0 – 19 years category and 5 patients (20%) in the 60 – 79 years category (Table 1). Our data shows a fairly even distribution amongst the various age groups with a slight peak in the younger age group (0 – 19 years). We attribute this to the fact that younger patients are more susceptible to ocular trauma.[21,26]

There are a few proven identifying risk factors that can assist in predicting if a patient with ocular will develop ARG. Some of these include poor initial visual acuity, advanced age, lens injury, angle recession, hyphaema,[8] elevated baseline IOP and angle recession of more than 180 degrees.[9,27] Many studies in developing and developed countries have shown the association between hyphaema and angle recession.[6,8,27-29] Patients who have hyphaema at time of injury are more likely to develop angle recession. In Iran,[30] 62% of patients with hyphaema had angle recession of more than 180 degrees. One study from Portugal[31] showed a 55.6% incidence of AR in patients with hyphaema. 56% of our patients had a history of hyphaema at the time of injury. Presence of hyphaema signifies compromise to the blood vessels of the anterior uvea (iris and/or ciliary body). Thus, the management of patients presenting with hyphaema needs to include gonioscopic evaluation of the angle at some point. This can at least help us to guide the future management of our trauma patients and to prevent any further loss of vision. Other associated clinical features found in our patients included traumatic cataract (32%), sphincter rupture, subluxated lens, posterior segment involvement (such as choroidal rupture and macula hole).

All of our patients had a degree of angle cleavage of more than 180 degrees with 17 (68%) of the patients having a degree of angle recession of 360 degrees (Table 2). This correlates with the general fact that patients with an angle recession of more than 180 degrees or more are more susceptible to developing glaucoma.[1,3,7-9] Apart from this, we had a higher number of patients with angle recessions more than 270 degrees (Figure 3) when compared to other similar studies.[19,30]

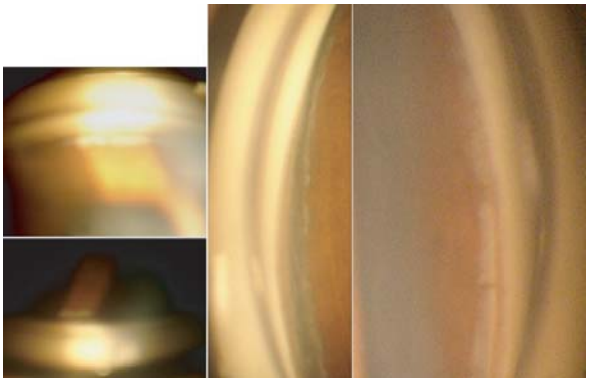

Figure 3 : Wide ciliary body band seen on gonioscopy.

The mean IOP at the time of diagnosis of Angle Recession Glaucoma was 29.8 ± 9.7mmHg (Range: 14 – 50mmHg). The mean IOP at last follow-up was 18.4 ± 8.4mmHg (Range: 10 – 50mmHg) ($p<0.017$). This is slightly lower than findings of a study done in the Cameroon[5] (mean IOP was 36.9 ± 13.8 mmHg, Range: 22 – 66 mmHg at the first examination and 24.3 ± 13 mmHg, Range: 12 – 29 mmHg at the last examination). The mean IOP at last follow up is comparatively lower in our study, even though three of our cases are still uncontrolled.

Of the 22 patients whose IOP were controlled, none of them required a surgical filtering procedure. 20 of these patients were controlled by conservative treatment (use of single or dual topical anti-glaucoma drugs or by observation) and the remaining 2 patients had surgical intervention (Small Incision Cataract Surgery [SICS] in both cases). The topical medications used varied and was based upon clinical judgement. They included mostly beta-blockers (timolol maleate) and alpha-2 agonists (brimonidine). From Figure 2 we can notice that, 5 of our patients required no intervention, which means that these patients can maintain a regular IOP (and also a stable glaucoma status) with their post-traumatic aqueous outflow pathways. The two patients who had SICS done were done primarily to relieve visual compromise due to cataract. As we saw they benefited additionally with a reduction in their IOP post-surgery. Three patients (12%) whose IOP were not controlled, even after the use of three topical drugs, were advised for filtering surgery.

The VA for 23 patients (92%) either remained stable or improved, in 2 (8%) patients the VA worsened. In the latter two patients, the decrease in VA over the follow-up period was due to progression of cataract. The last recorded VA of patients in the follow-up showed 7 patients (28%) having a VA of 6/18 and better, whilst 13 patients (52%) had a VA ranging from 6/24 to 3/60. 5 patients (20%) had a VA of CF at ½m and worse. The VA remained stable or improved in most of our patients, even though majority of our patients fell within the category ranging from 6/24 to 3/60. In most cases, the poor status of VA was due to a combination of causes including primary damage due to injury and glaucomatous damage due to delayed presentation.

We consider it significant to note that 88% of our patients could have been managed conservatively and without non-filtering surgical procedures. In 3 of our patients the IOP were not controlled (Figure 2), after being treated with topical medications, and their management options are presently being reviewed. Most studies suggest that management of ARG cases, as stated earlier, should be in a step-wise manner. First medically, then via laser therapy and for those that do not respond to these, there are surgical options available.[12,13] Two studies, one from Israel[32] and another from Japan[33] have shown good results with laser trabeculopuncture. When medical and laser therapies have failed, an incisional outflow operation is usually indicated such as trabeculectomy with mitomycin C[14-16] or implant. Trabeculectomy with mitomycin C has shown to be most effective even though there are risks of bleb failure[34] and bleb infection.[14]

Conclusion

Angle recession glaucoma can cause further loss of vision in ocular trauma patients who may already have compromised vision due to injury. Control of intra-ocular pressure and preservation of presenting visual acuity was seen in most cases with conservative management with topical medications and sustained follow-up. Patients sustaining blunt ocular trauma, especially those associated with hyphaema, should be advised for future follow up and have gonioscopic evaluation of the angle. All cases had an angle recession more than 180 degrees.

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