ORIGINAL RESEARCH PAPER

Medical Science

A HOSPITAL BASED PROSPECTIVE STUDY CORRELATING THE CENTRAL CORNEAL THICKNESS WITH INTRAOCULAR PRESSURE IN NORMAL AND GLAUCOMA SUBJECTS

KEY WORDS: Primary open angle glaucoma, Central corneal thickness, Intraocular pressure, Blindness

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ABSTRACT

Purpose: - To correlate the central corneal thickness with intraocular pressure in normal and glaucoma subjects. **Methods: -** Glaucoma is the leading cause of irreversible blindness worldwide. Raised IOP is a significant and only modifiable risk factor for glaucoma development and progression. That can be therapeutically or surgically managed. Our study was a hospital-based case-control study of 132 patients out of which 66 were normal (control group) and 66 were suffering from primary open angle glaucoma (case group). All patients underwent a compressive ocular examination as well as laboratory investigations and were subjected to surgical procedures. **Result: -** Our study included 132 patients out of which 66(50%) patients were normal and rest 66(50%) were glaucoma patients' majority of 47% (n=62) of the subjects belonged to the age group of 51-60 years and only 8.3% (n=11) belonged to 71-80 years of age. 71 (53.80%) were females and 61 (46.2%) were males. Mean IOP LE in glaucomatous cases is 14.45±1.571 mm Hg which is lower than control group (14.82±1.856 mm Hg). Mean CCT of normal subjects is 556±18.87 µm which is greater than the mean CCT of glaucoma subjects which is 527±31.92. The overall mean CCT of all subjects in the study is 542±29.72 µm. **Conclusion: -** Glaucoma is the second most common cause of blindness world-wide. Amongst the various associated risk factors, IOP is the only known factor that is amenable to therapeutic modification. Our study concluded that Normal population also have significantly greater CCT as compared to the glaucoma population. GAT intraocular pressure is significantly directly related to the CCT in all the individuals. On applying the appropriate correction factors, the corrected IOP is taken which should be considered while labelling individuals as normal or glaucoma patient.

INTRODUCTION

Glaucoma is a group of acute and chronic, progressive, multifactorial optic neuropathies where intraocular pressure among the other contributing factors is responsible for the characteristic loss of retinal ganglion cell axons leading to atrophy of the optic nerve with demonstrable classic visual field defects.[1] Glaucoma affects more than 67 million people world-wide of whom 10% or 6.6 million are estimated to be blind.[2] It is the leading cause of irreversible blindness world-wide and is second only to cataract. Quigley HA et al. (2006) in their study concluded that the second leading cause of blindness is glaucoma.[3] Raised IOP is a significant risk factor for glaucoma development and progression.[4] It is the only modifiable risk factor that can be therapeutically or surgically manipulated, thus its measurement is essential for disease detection and patient follow up. Other risk factors for glaucoma include elevated IOP, hereditary, myopia and race. The in uence of scleral rigidity and central corneal thickness on IOP readings was rst discussed by Goldmann H et al. (1957).[5] The diagnosis of glaucoma is made on the basis of an IOP cut-off point of 21 mm Hg (applanation tonometry). Thus, any factor that alters the value of the IOP can result in non-detection of patients having actual glaucoma. Clinical measurement of IOP has undergone several technical advances from the initial digital tension assessment, to indentation tonometry, further to applanation tonometry and presently, non-contact tonometry for mass screening. Goldmann applanation tonometry (GAT) has been universally accepted as the gold standard for determining IOP.[6] All devices that record IOP measurements have a trans-corneal approach and thus are indirect. Hence, IOP is always estimated rather than truly measured. Therefore, precise IOP measurement is subject to confounding variables like the influence of corneal biomechanical properties including corneal thickness. Central corneal thickness has become an important element of the clinical evaluation in glaucoma patients. CCT can be measured by optical and ultrasound methods; the latter has been shown to be more reproducible and reliable. CCT was assumed to be a constant variable (520 micrometer) when Goldmann designed applanation tonometer. IOP assessed by applanation tonometry may be overestimated or underestimated based on corneal thickness.

MATERIAL AND METHOD

Our study was a hospital-based case-control study of 132 patients which was done to clinically correlate the IOP and CCT.

METHODOLOGY

132 subjects were included in our study out of which 66 were normal (control group) and 66 were suffering from primary open angle glaucoma (case group). A written informed consent from all the patients who were enrolled in the study was taken. All the data of patients who were enrolled in the study and registration of all the cases with the preliminary particulars of the patient such as name, age, sex, occupation, socio-economic status, education and address was done.

The following were the inclusion and exclusion criteria of the study:

Inclusion Criteria For This Study

Group 1: Normal subjects

1. IOP 21 mm Hg
2. Normal Optic Disc
3. Angles open on gonioscopy
4. No suspicion of glaucoma

Group 2: Glaucoma subjects

1. IOP prior to treatment > 21 mm Hg with current IOP on treatment 21 mm Hg.
2. Glaucomatous optic disc +/- nerve fibre layer defects.
3. Glaucomatous field defects.
4. Open angles on gonioscopy.

Exclusion Criteria For This Study

1. Evidence of anterior segment pathologies like corneal opacities, keratoconus, lenticular opacities.
2. Previous intraocular or corneal surgery.
3. Use of contact lens and any other condition which might affect corneal thickness.

4. Corneal edema.
5. Corneal astigmatism > 2D.
6. Angle closure glaucoma.
7. Patient having systemic illness like - Diabetes mellitus and Hypertension.
8. Patients having history of taking drugs affecting IOP like corticosteroids, tricyclic antidepressants, anticholinergics, MAO inhibitors, antihistaminic, antiparkinsonian drug, antipsychotics, miotics, beta blockers, alpha 2 agonists, carbonic anhydrase inhibitors, prostaglandin analogues and hyperosmotic agents.

The patients underwent a detailed and comprehensive ocular examination. A detailed torch light examination was performed. Visual acuity was recorded on Snellen's chart-uncorrected (UCVA), with pinhole (PCVA) and best corrected (BCVA) for both the eyes. Slit lamp examination was done for anterior segment evaluation. Fundus was examined with both direct and indirect ophthalmoscopy. Intra ocular pressure was recorded with Goldmann applanation tonometer. Pachymetry was done in all subjects to measure central corneal thickness by ultrasound pachymeter. Patients were managed medically on antiglaucoma medications. Details of any surgical procedure; if present, were noted. All patients underwent a battery of routine investigations like blood pressure recording, blood sugar, urine sugar, haemoglobin levels to rule out hypertensive and diabetic retinopathy. All the data was analysed to clinically correlate the changes of CCT with IOP in patients with POAG.

RESULTS

Majority of 47% (n=62) of the patients belonged to the age group of 51-60 years and only 8.3% (n=11) belonged to 71-80 years of age. In our study 71 (53.80%) were females and 61 (46.2%) were males. Our study comprised of 66(50%) of normal patients (control group) and 66(50%) of glaucoma patients (case group).

Table no. 1 - Age distribution of the subjects (n=132 patients)

AGE (Years)	Frequency	Percentage
41-50	32	24.2
51-60	62	47.0
61-70	27	20.5
71-80	11	8.3
Total	132	100.0

Table no. 1. shows that majority of 47% (n=62) of the patients belonged to the age group of 51-60 years and only 8.3% (n=11) belonged to 71-80 years of age.

Table no. 2- Gender distribution of the subjects (n=132 patients)

SEX	Frequency	Percent
MALE	61	46.2
FEMALE	71	53.8
Total	132	100.0

Table no. 2 shows that from 132 participants, 71 (53.80%) were females and 61 (46.2%) were males. So, we have a slight preponderance of females in our study.

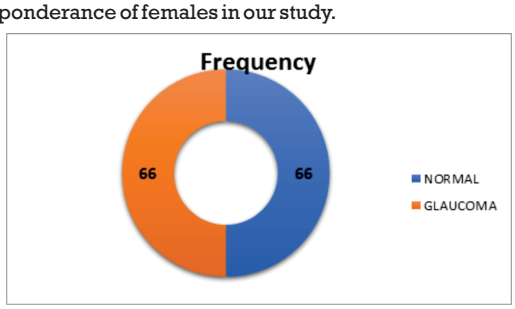

Figure no. 1 - Distribution of cases in study group (n=132 patients)

Our study was a case control study in which 66 patients were glaucoma subjects while control group has 66 normal patients.

Table no. 3– Mean IOP distribution between normal and glaucoma subjects.

Disease	N	Mean IOP	SD
NORMAL	66	14.67	1.93
GLAUCOMA	66	14.24	1.54
All subjects	132	14.46	1.76

The above table shows mean IOP of glaucoma patients 14.24±1.54 mm Hg which is less than the mean IOP of normal patients which is 14.67±1.93 mm Hg. The overall mean IOP of all subjects in the study is 14.46±1.76 mm Hg.

Table no. 4– Mean CCT distribution between normal and glaucoma subjects.

Disease	N	Mean CCT (m)	SD
NORMAL	66	556	18.87
GLAUCOMA	66	527	31.92
All subjects	132	542	29.72

The above table shows mean CCT of normal patients is 556±18.87 µm which is greater than the mean CCT of glaucoma patients which is 527±31.92. The overall mean CCT of all patients in the study is 542±29.72 µm.

DISCUSSION

Glaucoma is a progressive optic neuropathy characterized by a particular pattern of optic disc changes and visual field loss. It is a group of acute and chronic, progressive, multifactorial optic neuropathies where intraocular pressure among the other contributing factors is responsible for the characteristic loss of retinal ganglion cell axon. Majority of 47% (n=62) of the patients belonged to the age group of 51-60 years and only 8.3% (n=11) belonged to 71-80 years of age. Dusek W A et al. (2012) in their study found a statistically significant association between age and IOP in all subjects (P=0.002).[7] Wang SY et al. (2014) in their study found that increasing age is associated with thinner corneas in normal & glaucoma subjects.[8] Hoffmann EM et al. (2013) also reported that males have thicker CCT than females.[9] Our study found slight preponderance of female patients with females comprising of 53.8% (71 subjects) and males 46.2 % (61 subjects). Among the cases, 56.1% are females and 43.9% are males. In our study mean IOP of glaucoma patients 14.24±1.54 mm Hg which is less than the mean IOP of normal patients which is 14.67±1.93 mm Hg. The overall mean IOP of all subjects in the study is 14.46±1.76 mm Hg. IOP is low for cases than controls as they are on antiglaucoma medications during the course of study. These findings are in concordance with similar studies by Ehlers et al. (1975)[10] and Heijl A et al. (2002) suggested that raised IOP is an important risk factor for the development and progression of glaucoma.[11] The mean CCT RE in glaucoma subjects is 524.95±32.95 µm which is lower than normal subjects (554.80±19.205 µm). The difference between mean CCT RE between the cases and the controls comes out to be statistically significant (p=0.00). Similarly, the mean CCT LE in cases is 529.98±31.748 µm which is lower than 556.64±19.037 µm. The difference between mean CCT LE between the cases and the controls comes out to be statistically significant (P=0.000).

This confirms the findings that glaucoma patients have thinner corneas than the normal population. Similar findings were deduced by Gelaw Y. et al. (2012) in their cross-sectional study among Ethiopian glaucoma population.[12]

CONCLUSION

Our study concludes that normal population also have significantly greater CCT as compared to the glaucoma population. Intraocular pressure is significantly directly related to the CCT in all the individuals. On applying the appropriate correction factors, the corrected IOP is taken

which should be considered while labeling individuals as normal or glaucoma patient.

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