Correlation Between The Pressure-to-Cornea Index And Both Structural And Functional Measures Of Primary Open Angle Glaucoma In North Indian Population In And Around Lucknow

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ABSTRACT:

Background: Glaucoma is a potentially blinding disease known as "Sneak thief of Sight". It is the second leading cause of visual loss worldwide. Thus, making the recognition of all risk factors of utmost important. Early detection and diagnosis is essential so that treatment can delay disease progression. Intraocular pressure and Central corneal thickness are known risk factors for the progression of glaucoma.

Design: The following study is a prospective co-relational hospital based study.

Setting: Department of Ophthalmology, Vivekananda Polyclinic and Institute of Medical Sciences, Lucknow.

Methodology: 26 cases aged >40 years – 42 cases each with primary open angle glaucoma, ocular hypertension and those without POAG and ocular hypertension were enrolled. Demographic details of patients were noted, all the patients underwent detailed ocular examination, including assessment of visual acuity, intraocular pressure, optic disc status, central corneal thickness by pachymetry and visual field evaluation by Humphrey's perimetry. Corrected intraocular pressure adjusted for central corneal thickness and pressure to cornea index (PCI) values were calculated.

Results: Pressure-to-cornea index values ranged from 74.03 to 450.21 with an overall mean value of 153.96+59.40. Group I (210.64+63.53) followed by Group II (150.13+19.09) and Group III (101.12+13.74) respectively. All the between group differences were significant ($p<0.001$).

Conclusion: Evaluation of pressure-to-cornea index showed a significant difference with progressive increase from controls to OHT and finally culminating in POAG group. PCI had a highly efficient discriminant value too. PCI could be used as a sensitive indicator to evaluate progression of glaucoma and early glaucomatous changes.

Keywords: Glaucoma, intraocular pressure, central corneal thickness, pressure-to-cornea index

Introduction

Glaucoma is a potentially blinding disease that affects 66 million persons worldwide [1]. It is the second leading cause of visual loss in the world. With an expected increase in population and longevity, primary open angle glaucoma (POAG) is likely to become a major cause of ocular morbidity in the developing world. It is a multifactorial optic neuropathy in which there is characteristic atrophy of the optic nerve. The disease is characterized by typical changes in the optic nerve with associated visual field defects. In open-angle glaucoma, by definition, the anterior chamber angle is open by gonioscopic appearance. In this thesis, primary open-angle glaucoma is referred to as glaucoma. The etiology of POAG remains unclear despite a number of epidemiological studies that have investigated various potential risk factors for the disease.

Recognition of all risk factors for POAG is important for early diagnosis and intervention. It manifests mainly as peripheral visual field loss with central vision being preserved almost till the end stage. By the time the patient is symptomatic the visual loss is irreversible. Therefore, early diagnosis is essential so that treatment to halt progression can be instituted.

POAG is a neurodegenerative condition that is multifactorial in origin and numerous potential risk factors for development of the disease, in addition to intraocular pressure (IOP), have been identified [2]. An association between IOP and central corneal thickness has also been enumerated in a number of studies [3]. Central corneal thickness has recently been recognized as a significant risk factor for progression of ocular hypertension to primary open angle glaucoma (POAG). However, whether central corneal thickness can be taken as an independent predictor for development and progression of POAG often remains debatable owing to the fact that measurement of corneal thickness is affected by central corneal thickness. A reduced corneal thickness of 0.45mm could produce an underestimation of the IOP by up to 4.7mmHg, whereas an increased CCT of 0.59mm could cause an overestimation of 5.2mmHg when the actual IOP was 20mmHg. [4]

Considering this need, the present study was aimed to integrate intraocular pressure and central corneal thickness as a single risk factor for early detection and estimation of disease severity of primary open angle glaucoma at a tertiary care centre in Northern India.

METHODOLOGY

The proposed study was conducted over a span of one year, from May 2016 to April 2017 on a sample population attending ophthalmic clinic at Vivekananda Polyclinic and Institute of Medical Sciences, Lucknow which is a tertiary care referral centre and one of the largest hospital outside government sector in Lucknow. The sample size was calculated using the following formula Charan and Biswas (2013) [i]:

$n = 2(Z_{\alpha/2}+Z_{\beta})^2 SD^2/d^2$

where, n: Sample size per group

SD: Pooled standard deviation

d: Difference in the means (effect size)

$Z_{\alpha/2}$: critical value of z at 95% confidence

Z_{β}: critical value of z at 80% power

A total of 126 patients were included in the study and divided into three groups of 42 patients each. Group I included patints with confirmed diagnosis of primary open angle glaucoma, Group II included patients with ocular hypertension and Group III were normal healthy controls.After explaining the procedures, all subjects were asked to sign an informed consent and undergo a complete eye examination with evaluation of the visual acuity, anterior segment biomicroscopy, tonometry with the Goldmann tonometer, gonioscopy with a two mirror gonioprism, and optic disc assessment with 90 D Volk lens on a tropicamide dilated pupil. The IOP was measured after discontinuation of all glaucoma medications for at least 21 days. Standard automated perimetry (SITA standard 30-2) was done with the Humphrey Field Analyzer 730 with appropriate refractive correction. CCT was measured with ultrasonic pachymeter, and three measurements were averaged to obtain one single value.Data was analyzed using Statistical Package for Social Sciences (SPSS) version 21.0.

RESULTS

Age of cases ranged from 42 to 75 years with a mean age of 56.71±6.79 years with majority of patients in age group 51 to 60 years. Overall as well as in all the three groups, majority of cases were males. Though proportion of males was higher in Group II (69%) as compared to that in Groups I and III (54.8% and 52.4% respectively) yet this difference among groups was not significant statistically (p=0.245).

DISCUSSION

As glaucomatous visual field (VF) damage is irreversible, early detection of impairment is essential to attempt to reduce or halt VF progression by controlling intraocular pressure. Moreover, sometimes it is difficult to determine early glaucomatous changes. Often it has been proposed that functional and structural combination could define the risk of glaucoma and could also help in determining the extent of visual field damage in more objective terms.

Table 1: Intraocular Pressure, Central Corneal Thickness and Corrected Intraocular Pressure Evaluation

SN	Findings	Group I (n=42)	Group II (n=42)	Group III (n=42)	Statistical Significance
1.	Mean uncorrected IOP (mmHg)	23.95±6.31	23.33 ±2.68	15.95±2.23	F=48.02p<0.001
2.	Mean CCT (µm)	504.38±22.08	540.62±21.71	542.93±15.77	F=48.77p<0.001
3.	Mean Corrected IOP (mmHg)	26.57±6.32	23.55 ±1.77	16.12±1.78	F=78.86p<0.001

Table 2: Intergroup comparison of Pressure-to-Corneal Index

Group	No. of cases	Mean	Minimum	Maximum
I	42	210.64	120.87	450.21
II	42	150.13	122.63	191.65
III	42	101.12	74.03	133.33
Total	126	153.96	74.03	450.21

F=82.635; p<0.001

It was in the year 2007, when Iliev made an attempt to unify central corneal thickness and intraocular pressure as a unified risk factor as a new glaucoma index.[6] Though, theoretically upright and showing potential in that assessment, this index is still not been validated in different environments. In present study, we made an attempt to evaluate its usefulness for early detection and estimation of disease severity of primary open angle glaucoma at a tertiary care centre in Northern India.

In present study, a significant difference in corrected IOP was observed in all the three groups. The corrected IOP values showed a decreasing trend from POAG to OHT and control group. Thinner CCT showed a significant association with POAG which is similar to the study done by Moghimiet al. (2014)[7] who found that CCT of glaucomatous eyes to be significantly thinner as compared to non-glaucomatous eyes and is a powerful predictor for the development of POAG.

Evaluation of pressure-to-cornea index showed a statistically significant difference among different study groups, showing a progressive order from controls to OHT and finally culminating in POAG group. PCI had a highly efficient discriminant value too. It was observed that for all the between group comparisons the differences were significant statistically. These findings are in consonance with the observations made by Ilievet al. (2007)[6] who also found that mean PCI values showed a significant incremental trend starting from controls, OHT and POAG respectively.

CONCLUSION

It can be concluded that pressure-to-cornea index was a useful discriminating indicator to differentiate between POAG, ocular hypertension and healthy controls. PCI values also showed a good correlation with structural and functional parameters and severity of glaucoma.

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Effect Of Arcus Senilis On Intraocular Lens Power Calculation With Intraoperative Aberrometry

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ABSTRACT:

Setting: Brimhall Eye, Las Vegas, Nevada, USA

Design: CASE REPORT

Purpose: We report a case of arcus senilis affecting the accuracy of intraocular lens (IOL) power calculation using intraoperative aberrometry.

Methods: The Optiwave Refractive Analysis device (Alcon Laboratories, Inc.) requires the user to input optical biometric measurements such as axial length (AL), keratometry (K) values, lens thickness, anterior chamber depth, and white-to-white (WTW) diameter.There was a large difference in the predicted IOL power (+1.50 diopters) between the IOL power calculation using preoperative optical biometry and intraoperative IOL power calculation using intraoperative aberrometry (Optiwave Refractive Analysis). After the arcus senilis was adjusted for, by manually measuring the white-to-white distance intraoperatively and that new value was entered into the intraoperative aberrometer, the measurement matched the preoperative measurements and confirmed the correct choice of IOL.

Conclusion: We hypothesized that the intraoperative aberrometer predicted a much lower target IOL power because of the smaller WTW. After the WTW intraoperatively measured with calipers was inputted into the intraoperative aberrometer, the aberrometer's IOL power prediction aligned with that of the Barrett Universal II formula,confirming our hypothesis. Thus, it is imperative to review all preoperative measurements for symmetry between fellow eyes and identify any outliers because these might cause unexpected predicted IOL powers during surgery.