Inter ocular variability of common glaucoma parameters in patients with primary open angle glaucoma

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Abstract

Aim: To assess the intrasubject variability of CCT,IOP and VCDR in patients with POAG compared to normal.
Design: Cross sectional study.
Materials and Methods: A total of 100 eyes of patients on treatment for POAG and 100 eyes of normal individuals were included in the study. All patients underwent a complete ophthalmological examination including CCT corrected IOP, visual field by HFA and disc evaluation using 90D assisted slit lamp biomicroscopy. CCT was measured using ultrasonic pachymetry in all of them. The difference in IOP, Vertical CD ratio and CCT were compared between the two eyes in POAG patients and in normal individuals.
Results: The mean difference in IOP was 3.52±3.8 in POAG group compared to 1.06±0.9 in normal .The mean difference in CD ratio was 0.132±0.15 in POAG compared to 0.05±0.07 in normal. The mean difference in CCT was also significantly higher in POAG patients. [8.10±7.4] when compared to normal individuals [5.05±5.17].

Keywords: Central Corneal Thickness, Intraocular pressure, Inter ocular variability, Vertical cup disc ratio.

Introduction

Glaucoma is a disease characterized by gradual progressive optic nerve damage. Even though Intraocular pressure (IOP) is the only modifiable risk factor other risk factors include age, gender, race, family history, higher cup to disc ratio and thinner central corneal thickness (CCT). As per Yasuyuki Suzuki et al[(1)] together with IOP, myopia and age were significant risk factors for having primary open angle glaucoma (POAG). Inter eye IOP difference is well known to have prognostic and diagnostic importance in glaucoma. Similarly intra-subject variability of vertical cup to disc ratio (VCDR) is also well known. Very few studies are there to estimate the intra-subject variability of central corneal thickness. So in this study we are aiming to study about the intra-subject variability of IOP, vertical CD ratio, and CCT among POAG and normal individuals.

Methods

A total of 200 individuals, 100 normal individuals and 100patients on treatment for POAG were included in the study. Those with any other corneal disease or any intraocular surgeries or high refractive errors that can affect CCT were excluded from the study All patients underwent a complete ophthalmological examination including CCT corrected IOP using Goldmann applanation tonometry, CCT done by ultrasonic pachymetry [PACSCAN 300p model of SonomedInc], disc evaluation by 90D assisted slit lamp biomicroscopy, visual field analysis using Humphrey field analyser [Zeiss SR 7208371]. All of them were classified as mild, moderate, and severe based on the standard criteria. IOP, VCDR and CCT was compared between the two eyes in normal and POAG group. These were statistically analysed using SPSS software version18.One way ANOVA and t test was done to compare means and chi square test was done to test variance.

Results

Mean age was 58.41±9.6 in POAG group and 57.42±9.4 in normal. Females were predominant in both groups.
The details are given in Fig. 1.

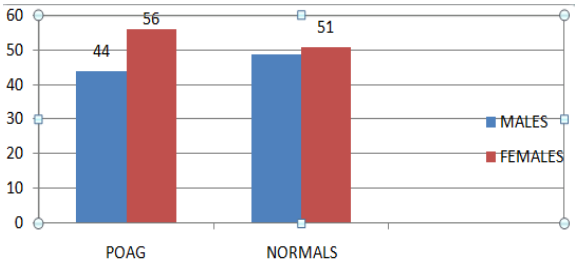

Fig. 1: Age and Sex distribution among glaucoma patients and normal individuals

The mean values of IOP, VCDR and CCT among POAG and normals are given in Table1.

Table 1: Mean values of IOP, VCDR and CCT among POAG and normal

		POAG	Normal	P value
IOP	RE	16.2±5.0	12.96±2.5	0.000
	LE	17.82±5.0	12.66±2.6	0.000
VCDR	RE	0.653±0.2	0.312±0.9	0.000
	LE	0.673±0.2	0.308±0.09	0.000
CCT	RE	528.03±33.37	541.46±31.20	0.004
	LE	529.69±34.14	541.25±30.32	0.012

The mean values of difference in IOP, Vertical CD ratio and CCT were compared between POAG and controls. The difference was significantly higher among POAG group compared to normal as shown in Table 2.

Table 2: Mean difference in IOP, VCDR &CCT between the two eyes in POAG &controls

	POAG	Control	P value
Mean diff in IOP	3.52±3.8	1.06±0.9	0.000
Mean diff in VCDR	0.132±0.15	0.05±0.07	0.000
Mean diff in CCT	8.10±7.4	5.05±5.1	0.000

Discussion

Mean age of patients in the POAG group was 58.41±9.6 and 57.42±9.4 in controls. Number of females were slightly higher [107] compared to males [93]. Number of females in POAG group was 56 compared to 51 in controls. Number of males were 44 in POAG compared to 49 in control group. So the two groups were comparable in terms of age and sex. The Chennai based study showed that majority of patients (85.22%) were in the age range of 40-70 years.[2] As regards gender, 58.26% were males where as 41.74% were females.[2]

Mean values of IOP in RE in POAG and control groups were [16.2±5.0 &12.96±2.5] respectively and [17.82±5.0 & 12.66±2.6] in LE respectively. In a study on Intraocular pressure asymmetry an indicator for glaucoma diagnosis by Williams AL et al the mean IOP in RE was [17.52±7.109 &14.32±3.151] in POAG and in controls respectively and [18.31±8.205 & 14.64±4.050] in LE respectively.[3] The values were almost similar to our present study. The inter ocular asymmetry of IOP was 3.52±3.8 in POAG group where as it was 1.06±0.9 in the control group. This difference was statistically significant even though these patients were on treatment for glaucoma. As per Williams et al if there is no IOP asymmetry then there is only 1% probability of developing glaucoma, if 3mmHg asymmetry then there is 6% probability of having glaucoma and a difference of 6mmHg is associated with 57% probability of developing glaucoma.[3] In the case of IOP asymmetry severe visual field defects was seen in patients with high mean IOP as per Crichton et al.[4]

The difference in the CD ratio between the two eyes were analysed and grouped into two [<0.6 or 0.6 or >] [cat 1&2] and compared between the two groups. The difference in CD ratio between the two eyes were definitely more among POAG group and that was also found statistically significant after analysing using chi square [<0.000] test.

The mean difference in the vertical CD ratio between the two eyes was 0.132±0.15 in POAG group and 0.05±0.07 in normal. In the blue mountain study the median value of VCDR asymmetry was 0.11 in POAG group and 0.06 in normal.[5] In a study conducted by Sharma B.D et al 82.8% of cases with disc cups asymmetry were found to be suffering from chronic simple glaucoma.[6] As per the blue mountain study a cup- disc ratio asymmetry of 0.2 or more was found in 24% of patients with OAG and in 6% of normal.[5]

The mean CCT in the normal group is 541.46±31.20 in RE and 541.25±30.32 in LE. The mean CCT in the glaucoma group was 528.03±33.37 and 529.69±34.14 in right eye and left eye respectively. According to a study conducted by natarajan et al the mean central corneal thickness in the control group was 536 µm (462-608 µm) and in the primary open angle glaucoma group was 531 µm (476-609 µm).[7] The mean central corneal thickness in subjects with POAG was 502.82 +/- 35.29 µm and that of the normal study population 505.93 +/- 31.11 µm as per Chennai glaucoma study.[2] In the above two studies there were no much difference between the central corneal thickness of normal individuals when compared to glaucoma patients. In the Barbados eye study the central corneal thickness of POAG patients (520.6±37.7) were significantly thinner than normal individuals (530.0±37.7).[8] As per OHTS study the mean CCT of participants who developed POAG was 553.1±38.8 and 574.3±37.8 in those who did not develop POAG.[9] Central corneal thickness is an independent risk factor for development of visual field loss among patients diagnosed with preperimetric glaucoma. It is important to consider CCT when determining target intraocular pressure of patients with glaucomatous optic neuropathy.[10]

Inter ocular asymmetry of CCT was measured in this study and the asymmetry was found to be 8.10±7.4 in POAG group and 5.05±5.1 in the normal group. Similar results were found in a study by Yazdani and Shahin et alin their study.[11] In their study the inter eye difference of CCT was 8±7µm in POAG patients and 5±3µm in normal individuals.[11] The values are comparable to our study. In a study by Sullivan mee et al a difference in CCT of at least 15µmis required before increased risk is evident.[12] However further studies are required to confirm this.

Topical antiglaucoma medications can affect central corneal thickness esp prostaglandins. As per Maruyama Yuko et al topical latanoprost can cause reduction in CCT during initial stage of use.[13] According to Matthias. G et al short duration application of dorzolamide caused thickening of the CCT in patients with cornea guttata. In the healthy control group no significant changes were noticed.[14,15]

The limitations of our study is that whether the thin CCT in the POAG group is drug induced or not was not studied here and also visual field correlation with thin CCT was also not done. However the strength of our study is that we have reasonably good number of POAG patients and controls.

Conclusion

This study concludes that intra-subject variability of IOP, VCDR and CCT is an important risk for glaucoma

so that while screening patients for glaucoma this asymmetry should be given importance and those with such an asymmetry should be more closely followed up.

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