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A CLINICALSTUDY ON CENTRAL CORNEAL THICKNESS AND CORNEAL ENDOTHELIUM IN PRIMARY OPEN ANGLE GLAUCOMA.

Ophthalmology

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ABSTRACT

AIM: to study the central corneal thickness and corneal endothelial changes in primary open angle glaucoma (POAG).

MATERIAL AND METHODS: A total of 70 diagnosed cases of POAG were included in this study. The study was conducted for a period of one year. All the patients were thoroughly worked up, including detailed history, comprehensive ocular and systemic examination.

RESULT: Our study observed that POAG was more common in fifth decade of life, the mean age being 54.88 + 9.39 years. Incidence of POAG was more in males (68.57%) as Compared to females (31.42%). In this study the mean central corneal thickness(CCT) was found to be 504.87+33.37 qm. This observation was statistically significant ($p<0.0001$). The mean corneal endothelial cell density was 2295.49+208.90cells/mm2. This observation was statistically highly significant($p<0.0001$).

CONCLUSION: POAG is a chronic slowly progressive blinding disease in which thinner Central corneal thickness has a significant association as well as there was a statistically significant reduction in mean endothelial cell density.

KEYWORDS

POAG, tonometry, OCT, CCT, Corneal endothelium.

INTRODUCTION:

Glaucoma is a diverse group of eye diseases with multifactorial etiology, characterized by an acquired loss of retinal ganglion cells , progressive optic neuropathy with morphological abnormalities in optic nerve head (OPH) and, visual field defects, in which raised intraocular pressure (IOP) is amajor and only modifiable risk factor.[1] The estimate prevalence of glaucoma in the world was 60.5 million in 2010 and is expected to increase to 79.6 million in 2020. [2]

The diagnosis of POAG may be delayed due to lack of symptoms. Glaucoma is a lifelong disease and is a leading cause of irreversible but preventable blindness (5.80) in India next only to cataract(62.50%).[3]

Primary open angle glaucoma(POAG) is a subset of glaucoma defined typically as a chronic , slowly progressive optic neuropathy with characteristic patterns of optic nerve damage and visual field loss.

The measurement of central corneal thickness (CCT) is an important factor in the evaluation and management of patients with POAG and the measurement of IOP by applanation tonometry (AT) is affected by central corneal thickness. IOP measurement by applanation tonometry is influenced by central corneal thickness.[4] If cornea is thinner, an underestimation of IOP is likely to result, and if thicker an overestimation.[5]

There is also evidence that elevated IOP often induces secondary changes in corneal endothelium. Reduced cell densities haven been reported in association with open angle glaucoma.[6] Specular microscopy allows in vivo examination of corneal endothelial morphology and function.[7]

MATERIALS AND METHODS:

The study was conducted for a period of one year and a total number of 70 patients who were diagnosed as POAG were selected from the outpatient department for the study. Informed consent were taken from each patient before including them in the study .

INCLUSION CRITERIA

All patients 40 years and above investigated and diagnosed as POAG.

EXCLUSION CRITERIA:

1) Primary narrow angle glaucoma
2) Secondary glaucoma
3) Congenital glaucoma
4) Cases with lenticular opacity or scarring.

A detailed history and thorough ocular examination were carried out including visual acquity, Refraction,Tonometry, Slit lamp biomicroscopy, Goniscopy, Fundus evaluation with + 90 D convex lens, Perimetry with Humphrey visual field analyser, Optical coherence tomography (OCT) and Specular microscopy .

Specular Microscopy: The CCT and corneal endothelial cell density were measured using specular microscope (TOPCON SP 3000 P) . It captures the image of the endothelial cells and calculates by unique method that does not require the touching of the cornea. There is no risk of transmitting infectious diseases and reduces potential physical injury.

The data, collected on various aspects of this study were compiled and subjected to statistical analysis. Probability values (p) were used and p-value < 0.05 was considered statistically significant.

21-30	46	65.71
31-40	11	15.71
>40	1	1.42

TABLE 4. IOP DISTRIBUTION IN LEFT EYE :

IOP(mmHg)	No. of eyes	Percentage(%)
10-20	18	25.17
21-30	43	61.42
31-40	7	10
>40	2	2.85

In our study majority of the eyes had intraocular pressure in the range of 21-30 mmHg i,e 46 (65.71%) in the right eye and 43 (61.42%) in the left eye. 12 (17.14%) right eyes and 18 (25.17%) left eyes had IOP in the range of 10-20 mmHg. 11 (15.71%) right eyes and 7(10%) left eyes had IOP in the range of 31-40 mmHg. The highest IOP recorded was 50 mmHg. The mean IOPO recorded was 25.48 mmHg (right eye) and 24.34 mmHg (left eye).Overall mean IOP was 24.91± 6.26 mmHg.

3. CENTRAL CORNEAL THICKNESS :

TABLE 4 : CENTRAL CORNEAL THICKNESS DISTRIBUTION IN RIGHT EYE AND LEFT EYE

CCT (µm)	Right eye	Left eye
400-440	2	1
441-480	18	13
481-510	20	28
511-540	15	14
541-580	15	14

The study shows that 20 right eyes (28.57%) and 28 (40%) left eyes had CCT ranging from 481-510 µm.

TABLE 5 : TABLE SHOWING THE STATISTICS OF CENTRAL CORNEAL THICKNESS IN POAG PATIENTS.

	RIGHT EYE	LEFT EYE
MEAN	502.8	506.95
STANDARD DEVIATION	35.33	31.40
STANDARD ERROR OF MEAN	2.98	2.65
95% CI	496.89 508.70	501.70 512.19
MINIMUM	407	430
MAXIMUM	577	567

Our study shows that, the mean central corneal thickness was 502.8µm (right) and 506.95µm (left). Highest central corneal thickness recorded was 577µm and lowest was 407µm. Irrespective of the eyes the mean central corneal thickness was 504.87±33.37µm.

TABLE 6: TABLE SHOWING THE CORRELATION BETWEEN CCT OF RIGHT AND LEFT EYE :

CCT IN	EYE	NO	MEAN	SD	P-VALUE
POAG	RE	70	502.8	35.33	0.46
PATIENTS	LE	70	506.95	31.40	0.46

The mean CCT for right and left eyes were 502.8 and 506.95µm .
There was found to be no statistically significant difference in CCT value of right and left eyes by t test. (p value=0.46)

2. CORNEAL ENDOTHELIAL CELL DENSITY :
The corneal endothelial cell density in our study ranged from 1648 to 2842 cells/mm^2.

TABLE 7: SEX SPECIFIC ENDOTHELIAL CELL DENSITY DISTRIBUTION :

Sex	Mean±SD(cells/mm^2)	p-value
Males	2285.68±203.84	0.46
Females	2316.88±207.63	0.46

t=0.8359, p=0.46
The mean endothelial cell density of 48 males were 2285.68±203.84 cells/mm2 and 22 females were 2316.88±207.63 cells/mm2. This was not statistically significant (p=0.46)

TABLE 8 : AGE SPECIFIC ENDOTHELIAL CELL DENCITY

Age group	Range of endothelial cell density(cells/mm^2)	Mean±SD(cells/mm^2)
40-49	1880-2752	2376.38±199.23
50-59	1928-2754	2277.53±198.25
≥60	1648-2488	2193.76±192.60

TABLE 9 : STATISTICS OF CORNEAL ENDOTHELIAL CELL DENSITY

	RIGHT EYE	LEFT EYE
MEAN ECD	2304.31	2286.71
STANDARD DEVIATION	197.18	199.93
STANDARD ERROR OF MEAN	23.56	23.89
95% CI	2257.29 / 2351.32	2239.03 /2338.34
MINIMUM	1648	1764
MAXIMUM	2752	2842

The mean endothelial cell density in the right eye was 2304.31cells/mm^2 and left eye was 2286.71 cells/mm^2. The overall mean being 2295.49±208.90 cells/mm^2. The lowest endothelial cell density was found to be 1648 cells/mm^2 and highest to be 2842 cells/mm^2.

DISCUSSION:
Age distrntsibution: Present study showed maximum number of patients were in the fifth decade of life. The mean age of the patients in our study was found to be 54.88 years. The mean age in our study was similar with other Indian studies like Chennai glaucoma study[8] , Narayan M et al[9], Tidake P et al[10].

Sex distribution: Males were found to be more affected 48(68.57%) than females 22(31.42%) in our study. Similar findings were reported by various authors like Narayan M et al [9] , B N Mukesh et al.[11]

CENTRAL CORNEAL THICKNESS: In our study , the mean CCT was found to be 504.87±33.37µm. This observation was statistically significant using one sample t test(p<0.0001). The mean CCT for right eyes and left eyes were 502±35.33 and 506.95±31.40 µm. Similar observations were made by studies done by Chennai glaucoma study [8], Mokbel TH and Ghanem AA. [12]

CORNEAL ENDOTHELIAL CELL DENSITY:
The corneal endothelial cell density in our study ranged from 1648 cells/mm^2 to 2842 cells/mm^2 with the mean being 2295.49±208.90 cells /mm^2. This observation was statistically highly significant using one sample t test (p<0.0001). The mean endothelial cell density of 48 males were 2285.68±203.84 cells / mm^2 and 22 females were 2316.88±207.63 cells /mm^2. This was not statistically significant (p=0.49).

In our study endothelial cell density decreased with increasing age and a significant reduction in the corneal endothelial cell count in POAG. Studies done by various authors like Zarnowski T, Lekawa A et al[13], Saulius G, Dalia K et al[14] , C Prasannakumary, T K Ragi et al[15] also reported similar findings .

Thus the results of our study in agreement with other studies showed that there was a significant decrease in corneal endothelial cell count in POAG. However as most of our patients were in the fifth decade of life and above, so age might also be a factor for decreased endothelial cell count in our study group. Further longitudinal studies are warrented for evaluating the impact of POAG on corneal endothelial cell density.

CONCLUSION:
Primary open angle glaucoma is a chronic , slowly progressive disease with diminution of vision as the main clinical presentation. The study concluded that there was a significant association between Central corneal thickness and POAG. In POAG there was thinner Central corneal thickness. The study also showed a significant reduction in corneal endothelial cell density. Measuring CCT and endothelial cell density in glaucoma patients may help to identify those patients who are at higher risk of developing severe glaucomatous sequelae thus enabling the Ophthalmologists to treat the disease more aggressively.

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