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CENTRAL CORNEAL THICKNESS IN NORMAL TENSION GLAUCOMA, PRIMARY OPEN-ANGLE GLAUCOMA, AND OCULAR HYPERTENSION: A COHORT STUDY.

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ABSTRACT

Background:
Aim: The main goal of this research is to assess the corneal thickness of individuals with primary open-angle glaucoma (POAG), ocular hypertension (OHT), and normal tension glaucoma (NTG).

Methods:
This study was done from June 2022 to May 2024. 150 patients were included in this research. A detailed history of the individuals was recorded, and a clinical examination was done. Further, an optical evaluation was done to diagnose any defect in the cornea. Direct Ophthalmoscope was utilized to rule out any harm to the optic nerve. An indirect ophthalmoscope was used for the detection of any defect in the retina.

Results:
The study found that the majority of patients were aged 51-60 years (47.8%), with 62.7% being male. The distribution of patients included 36.2% normal, 19.8% NTG, 28.7% POAG, and 15.3% OHT. The mean intraocular pressure (IOP) for males was 21.56±5.30 (right eye) and 19.60±4.79 (left eye), while for females it was 21.16±5.47 (right eye) and 20.70±4.06 (left eye), with NTG patients exhibiting significantly lower central corneal thickness (CCT) leading to potential misdiagnoses of POAG and normal cases as NTG and OHT.

Conclusion:
The CCT in normal tension glaucoma cases was notably low. Because of the intra-optical pressure outcome of CCT measurement, a lot of primary open-angle glaucoma cases were wrongly diagnosed as normal tension glaucoma cases and normal cases were wrongly diagnosed as ocular hypertension leading to mistreatment

Recommendation:
Clinicians should routinely measure central corneal thickness to improve the accuracy of glaucoma diagnosis and ensure appropriate treatment.

Keywords: *Corneal Thickness, Ocular Hypertension, Glaucoma*
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INTRODUCTION

Glaucoma is a persistent optical neuropathy with a typical occurrence of an optical disc and a particular order of vision deformity, which is related commonly but not always to an increased intra-optical pressure (IOP). Increased IOP is the main reason for glaucoma. When a glaucomatous optical nerve is not harmed then IOP will be normal. Intra-optical pressure is greater in patients having a history of glaucoma in the family. As age advances optical pressure increases and is common in both genders [1]. Tonometry is the basis for the grouping and treatment of glaucoma. Direct manometry is a precise method for the measurement of intra-optical pressure, even though it is unfeasible.

Tonometer with indentation, tonometer for applanation, and tonometer without contact are the three kinds of tonometers utilized. Tonometer with indentation can be easily transported, is economical, and utilized in the operation theater [2]. The drawback of tonometry with indentation is at the time of indentation it leads to inconsistent discharge of intraocular blood. A tonometer for appalanation is a precise method for measuring intra-optical pressure [3].

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However, the tonometer for application is not secure to utilize on children and it cannot be utilized in operating rooms. Infections are not transmitted during the utilization of tonometers without contact and do not cause any damage to the cornea.

Gonioscopy is used for getting the precise detection and subsequently, providing required therapy. Gonioscopy can be classified as direct gonioscopy and indirect gonioscopy. In research by Wolf et al [4], it was found that IOP and central CCT are related to each other. In research by Bron et al [5], it was seen that patients with ocular hypertension raised central corneal thickness. CCT (Central cornel pressure) plays a vital role in estimating desirable intraocular pressure degree which helps in the management of glaucoma.

The main goal of this research is to assess the corneal thickness of individuals with ocular hypertension (OHT), primary open-angle glaucoma (POAG), and normal tension glaucoma (NTG).

MATERIALS AND METHODS

Study design

A prospective cohort study.

Study location and duration:

The current research was conducted in Tertiary Eye Care Hospital from June 2022 to May 2024.

Participants

150 cases were included

Inclusion criteria

- Cases with NTG with intracortical tension less than 21mmHg.
- Cases with POAG with uncontrolled intracortical tension more than 21mmHg.
- Cases with ocular hypertension along with uncontrolled intracortical tension of more than 21mmHg.
- Patients who gave consent.

Exclusion criteria

- Any disease of the cornea.
- Patients underwent intra-ocular treatment.

Sample size

To calculate the sample size for this study, the following formula was used for estimating a proportion of a population:

$$n = \frac{Z^2 \times p \times (1-p)}{E^2}$$

Where:

- n = sample size
- Z = Z-score corresponding to the desired level of confidence
- p = estimated proportion in the population
- E = margin of error

Data collection

The subject's history was noted and recorded and clinical examination was performed. Further, an optical evaluation was done to diagnose any defect in the cornea. Direct Ophthalmoscope was utilized to rule out any harm to the optic nerve. An indirect ophthalmoscope was used for the detection of any defect in the retina.

Bias

Enrolling successive suitable subjects decreases selection bias. Possible roots of bias were dealt with by systemized documentation collection process and statistical analysis.

Statistical analysis

The statistical evaluation was accomplished using SPSS version 21.0. The frequency and percentage were used to characterize the categorical data.

Ethical consideration

The current research was permitted by the review board of the institute. Written consent was taken from all the participants. The research was conducted as per the ethical principles of the institution.

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RESULTS

Table 1: Demographics of the participants.

Parameters	Number of cases	Percentage
Age range		
40-50 years	24	19.2%
51-60 years	78	47.8%
61-70 years	30	19.6%
Above 70 years	18	13.4%
Gender		
Men	93	62.7%
Women	57	37.3%

As shown in Table 1, 24 subjects fell in the age group of 40-50 years and a larger number of the cases, that is 78 fell in the age range of 51-60 years. 30 subjects fell in the age range of 61-70 years and 18 cases were above 70 years of age. 93 cases were men, and 57 cases were women. It shows the defect is more common in men than in women.

Table 2: Classification according to the study group.

Study group	Frequency	Percentage
Normal	51	36.2%
Normal tension glaucoma	30	19.8%
Primary open-angle glaucoma	39	28.7%
Ocular hypertension	30	15.3%
Total	150	100%

In Table 2, 51 patients were normal. 30 patients had normal tension glaucoma. 39 patients had POAG and 30 patients had ocular hypertension.

Table 3: Contrast between the mean of intra-optical pressure in the right and left eye.

Gender	Intra-optical pressure in the right eye		Intra-optical pressure in the left eye	
	Mean	Standard deviation	Mean	Standard deviation
Male	21.56	5.30	19.60	4.79
Female	21.16	5.47	20.70	4.06
Total	21.40	5.37	20.0	4.40
	P=0.719		P=0.239	

Table 3 displays the average IOP in the right eye of males and females, respectively, which are 21.56±5.30 and 21.16±5.27. In the left eye of males, the mean IOP was 19.60±4.79, while in the left eye of females, it was 20.70±4.06.

DISCUSSION

In the present research of 150 cases, participants were in the age group of 40 years to 70 years. As per the age range, 24 individuals were in the range of 40-50 years, 30 individuals were in the age range of 60- 70 years, and 18 individuals were above 70 years of age. In the present research, it was seen that 93 patients were men and 57 patients were women. As per this research, 46% of the males were in the age range of 50-60 years and the majority of the cases were also in the age range of 50-60 years in women. This shows that there is relation between the age and gender of the patients. According to many research cases with normal tension, glaucoma has thin CCT whereas cases with ocular hypertension have thick central corneal thickness [6-8]. According to research [4], there was no relationship between the age and sex of the subjects.

As per the present research, 36.2% of the cases were normal, 19.8% of the patients had normal-tension glaucoma, 28.7% of patients had primary open-angle glaucoma and 15.3% of cases had ocular hypertension and related to the study [4].

The average age of men in the present research was 56.8±8.8 and the average age of females was 57.5±9.2. The mean age of ocular hypertension patients was moderately greater as compared to normal tension glaucoma and POAG. The result was similar to the research [9]. The mean IOP in the right eye was 21.56±5.30 in males and 21.16±5.47 in women. Men's mean IOP in the left eye was 19.60±4.79, whereas women's mean IOP was 20.70±4.06.

The current study found that the right eye's mean IOP was 21.40±5.30. The left eye's mean IOP was 20±4.56. The normal category's right eye's IOP was 22.46±4.90, POAG was 21.30±5.80, NTG was 21.40±5.70, and intraocular hypertension was 19.10±4.70. In patients with normal-tension glaucoma, the mean IOP of the left eye was 19.59±4.70; in those with POAG, it was 20.40±4.90. The outcome is consistent with studies [9].

GENERALIZABILITY

The findings of the current study cannot be specified for a major number of patients.

CONCLUSION.

In the present research, it was concluded that the CCT in normal tension glaucoma cases was notably low. Because of the intra-optical pressure outcome of CCT measurement, a lot of POAG cases were wrongly diagnosed as normal tension glaucoma cases, and normal cases were wrongly diagnosed as ocular hypertension, which led to mistreatment.

LIMITATION

The number of patients in this study was low which is the major limitation of this research.

RECOMMENDATION

Calculation of CCT helps the clinician in the proper detection of and appropriate treatment of glaucoma. Clinicians should routinely measure central corneal thickness to improve the accuracy of glaucoma diagnosis and ensure appropriate treatment. Further research with a larger sample size is recommended to validate these findings and enhance generalizability.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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ABBREVIATIONS

SPSS- Statistical Package for Social Sciences
CCT- Central corneal tension
NTG- Normal tension glaucoma

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