

“Central corneal thickness in glaucomatous and nonglaucomatous eyes using ultrasonic pachymetry.”

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ABSTRACT: The main objective of our study is to compare the central corneal thickness measured using ultrasonic pachymetry in glaucomatous and non glaucomatous eyes of the patients at Father Muller medical college Hospital, Mangalore India. It has been shown that if a patient has an abnormal CCT, the true IOP level may be masked, resulting in undertreatment or overtreatment of glaucoma. 120 Patients were selected and the CCTs of all the participants were measured using ultrasonic pachymetry. The IOPs were measured by using applanation tonometry the mean CCT of the normals was $523.97 \pm 21.90 \mu$, the mean NTG was $502.96 \pm 11.31 \mu$, the mean POAG was $518.69 \pm 23.59 \mu$ and the mean OHT was $542.50 \pm 22.71 \mu$. The study did not find any statistical significance among the four groups (POAG, NTG, OHT and controls). IOP needs to be corrected for CCT before classifying the type of glaucoma.

Key words: Normal tension glaucoma (NTG), Primary open angle glaucoma (POAG), Ocular hypertension (OHT), Central corneal thickness (CCT), Intraocular pressure (IOP).

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I. INTRODUCTION

INTRAOCCULAR PRESSURE (IOP) is an important parameter in the diagnosis and follow-up of glaucoma. While Goldmann applanation tonometry is the preferred method of measurement of IOP, several factors, including corneal thickness, may influence its accuracy⁽¹⁾. The integration of Central corneal thickness (CCT) in Intraocular pressure (IOP) measurement may potentially change the diagnosis and care of our glaucoma patients⁽¹⁾.

It has been shown that if a patient has an abnormal CCT, the true IOP level may be masked, resulting in undertreatment or overtreatment of glaucoma⁽³⁾. Patients with thinner corneas tend to have underestimated IOPs (their true IOPs are higher than the measured value), whereas those with thicker corneas tend to have overestimated IOPs (their true IOPs are lower than the measured value)⁽²⁾.

Increased IOP is considered the main risk factor for glaucoma. Measurement of IOP involves applying a force against the cornea that produces a distortion of the globe⁽²⁾. Earlier studies revealed that a true IOP of 20 mm Hg tonometry could underestimate the IOP by 5.2 mm Hg or overestimate it by 4.7 mm Hg, depending on the corneal thickness⁽³⁾.

II. AIMS AND OBJECTIVES

- To compare central corneal thickness measured using ultrasonic pachymetry in glaucomatous and non glaucomatous eyes.
- The effect of CCT on the diagnosis and management of glaucoma patients.

III. MATERIALS AND METHODS

- Randomly selected patients attending ophthalmology OPD at father Muller Medical College Hospital Mangalore.
- Sample size: 120 patients.
- The following formula was used to work out the sample size. $n = 2(Z\alpha + Z\beta)^2 \sigma^2 / (X_1 - X_2)^2$, $Z\alpha = 1.96$ at 95% confidence interval, $Z\beta = 1.281$ at 90% power, $X_1 \pm \sigma_1 = 527.65 \pm 21.9$ and $X_2 \pm \sigma_2 = 503.91 \pm 11.31$.
- In our study, sample size n is 120 after substituting the respective values.
- Statistical analysis will be done by using Mann Whitney U tests, ANOVA test and student t test. Descriptive statistics by using Statistical Package for social sciences (SPSS) version 20.0.
- Study design: Observational study
- A written informed consent will be taken from each patient enrolled in this study.
- Detailed examination involving visual acuity, slit lamp examination, IOP measurement using GAT, Gonioscopy, dilated fundus examination for ONH evaluation.

- After applying a drop of 4% xylocaine for local anesthesia, the pachymeter tip was placed perpendicularly on the cornea and it was centered over an undilated pupil. The readings were taken when the pachymeter made a beep. From each eye, 3 readings were taken and the average was calculated.

IV. SELECTION CRITERIA

Inclusion criteria:

CONTROLS:

- Eyes with healthy cornea in the age group of above 18years.

CASES:

- Both sexes above the age of 18 years.
- Those with Primary Open angle Glaucoma (Glaucomatous optic nerve damage, glaucomatous visual field defect and IOP more than 21mm Hg and an open angle on gonioscopy.)
- Those with Normal tension glaucoma: Glaucomatous optic nerve damage, glaucomatous visual field defect, IOP less than or equal to 21mm Hg (without treatment).
- Those with Ocular hypertension: IOP of 22mm Hg or more in the presence of normal optic nerve head, normal visual field and normal gonioscopy.
- Newly diagnosed cases will be taken, if on any medications then CCT among different groups will be taken into consideration.
- Patients willing to provide informed consent.

Exclusion criteria:

- Age less than 18years.
- Corneal infections, dystrophies, ectatic conditions.
- Secondary glaucoma, angle closure glaucoma.
- On drugs altering IOP (corticosteroids, MAO inhibitors, antiparkinsonism drugs, antipsychotics).
- Pseudophakics and Post-keratoplasty patients.
- Recent contact lens wear.
- Injury to eye.

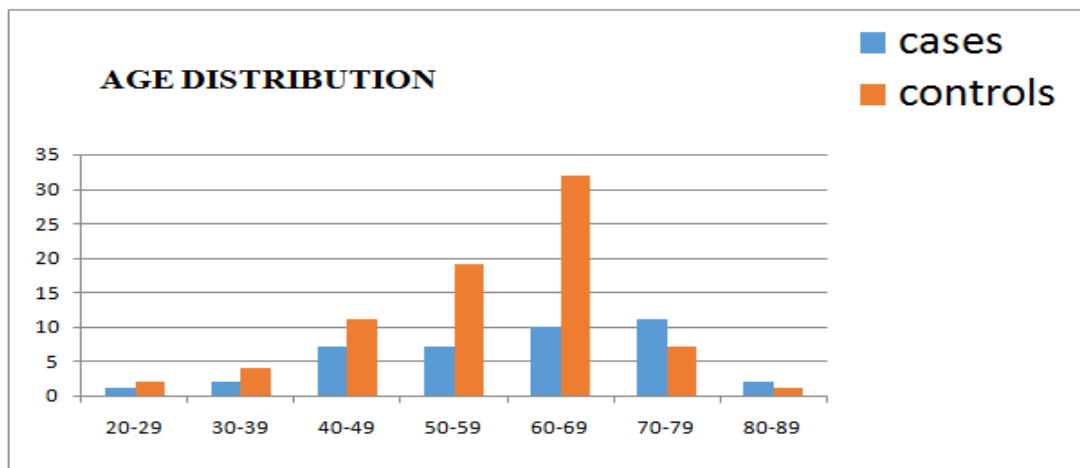
V. RESULTS

A total of 120 patients (22 men, 18 women in case group and 39 men, 41 women in control group) participated in the study.

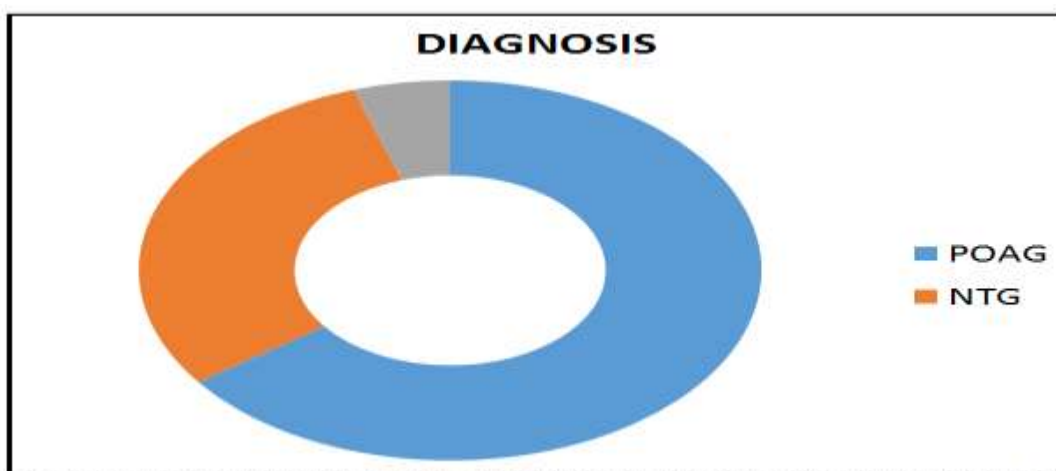
Cases	Controls
40(80 eyes)	80(160 eyes)

- Mean age among cases was 60.23 years
- Mean age among controls was 56.05 years

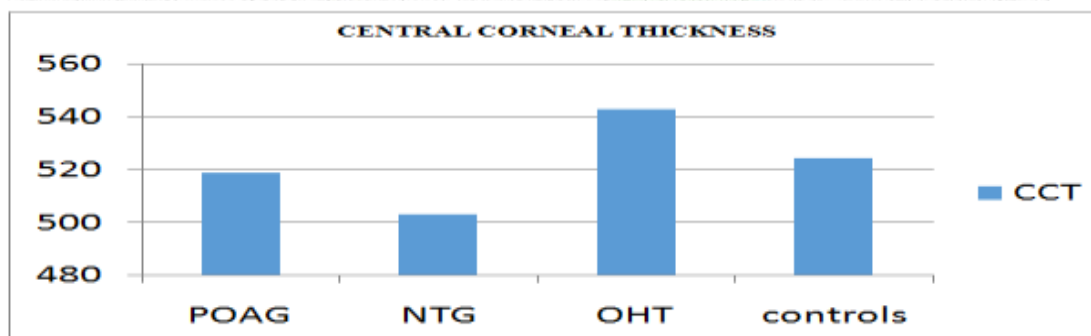
Age	Cases	Controls
20-29 years	556µm	536.5µm
30-39 years	511.5µm	535.25µm
40-49 years	527µm	522.08µm
50-59 years	529.42 µm	528.47µm
60-69 years	559.55µm	522.77µm
70-79 years	507.72µm	522.25µm
80-89 years	485µm	533µm



GRAPH SHOWING FREQUENCY OF AGE DISTRIBUTION



PIE CHART SHOWING DISTRIBUTION OF TYPES OF GLAUCOMA(POAG=26,NTG=12,OHT=2)



- Average central corneal thickness in NTG was 502.96 µm
- Average central corneal thickness in POAG was 518.69 µm
- Average central corneal thickness in OHT was 542.5 µm
- Average central corneal thickness among the controls was 523.97µm

Present study versus other studies:

	POAG	NTG	OHT	normals
Our study	518.69 µm	502.96 µm	542.5 µm	523.97µm
Bechmann et al	512 µm	482 µm	593 µm	530 µm
Ventura et al	515µm	518µm	563µm	524µm
Copt et al	543µm	521µm	583µm	552µm

	POAG	NTG	OHT
Mean IOP	21.31mm Hg	14.75mm Hg	20.5mm Hg
Corrected mean IOP	22.94mm Hg	17.43mm Hg	20.75mm Hg

The difference between the two was statistically significant ($p < 0.001$)

VI. DISCUSSION

Our study demonstrated age related decrease in CCT after the seventh decade. No significant association of CCT has been found with age.⁽⁴⁾ Though many studies demonstrated significant age-related decrease in corneal thickness by about 5 μm per decade in males and 6 μm in females.^(5,6)

The mean CCT in males was 519.57 μm and in females was 522.37 μm . There was no statistical significance found. Other studies have shown that CCT in females was found to be higher than in males⁽⁷⁾, lower than males⁽⁸⁾ and independent of gender⁽⁹⁾

Many studies have shown that the central corneal thickness was thinner in NTG patients and found to be thicker in OHT when compared to normal.^(5,7) Our study compared the central corneal thickness between the four groups (normal, NTG, OHT, POAG) and found that there was no statistically significant difference among the four. In our current study, the CCT of the NTG patients was lower than that of the POAG group, while the OHT patients had higher central corneal thicknesses than those of the controls and the POAG. No significant difference in the CCT was found between the four groups.

The Early Manifest Glaucoma Trial has shown that higher (lower) mmHg of IOP on follow up was usually associated with approximately about a 10% increased (or decreased) risk of progression. In early glaucoma, the key factor is based on lowering of IOP which will reduce the progression risk in half of the patients. This is well demonstrated by the Early Manifest Glaucoma Trial treatment.

The limitation of this study is that no long term follow up was done and the sample size was small to support the clinical implications of the changes which were made in their management, based on the CCT and corrected IOP.

VII. CONCLUSION

Our study showed that the central corneal thickness was lower in the normal tension glaucoma patients as compared to that in controls and the primary open angle glaucoma patients, while the ocular hypertension patients had higher central corneal thicknesses than the controls and in the primary open angle glaucoma patients. But the study did not find any statistical significance among the four groups.

In the management of glaucoma patients, adjusting the IOP after correction of the corneal thickness, will prevent the over or under treatment of the patients. It also helps in deferment of the incisional surgeries. Measurement of the central corneal thickness acts as helping aid to all the ophthalmologist in order to ensure the correct diagnosis and manage accordingly, especially when the corneal thicknesses are not within the normal range.

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