

Correlation between the Central Corneal Thickness and Glaucoma among Sudanese Patients



Medical Science

KEYWORDS :

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ABSTRACT

Objectives: To determine the mean central corneal thickness (CCT) in adult glaucomatous and Sudanese patients and to compare them with normal subjects and to evaluate its association with the type of glaucoma and glaucoma severity.

Methods: This was a cross sectional study, conducted at Khartoum ophthalmic clinics. It included one hundred subjects, divided into 2 groups: 50 patients with glaucoma, and 50 normal subject as control group. They were examined using the available tools for ophthalmic examination, the central corneal thickness was measured by ultrasonic pachymetry and the intra ocular pressure was measured by Goldmann applanation tonometry.

Results: The mean CCT in the normal subjects was (538.2±32.1µm) and in the glaucomatous patients was (510.8±32.4 µmw) with a (p=0.01). The mean CCT in open angle subjects was (508.9±29.0µm) being the thinnest, followed by narrow angles (516±148.1µm) then closed angle glaucomatous patients (510.8±32.4µm)(p=0.05). There was no correlation between mean CCT and the stages of glaucoma severity (P=0.7).

Conclusion: CCT of Sudanese glaucomatous patients was found to be thinner than in normal subjects. The mean CCT being the thinnest in open angle glaucomatous patients followed by narrow angle then closed angle patients. There is no correlation between mean CCT and the stage of glaucoma severity.

Introduction:

Blindness is a devastating handicap with human and socio-economic implication.

Glaucoma is the second leading cause of irreversible blindness worldwide^[1]. In Sudan 17% of all blindness is due to glaucoma^[2].

Many times, patients with thin corneas (less than 555 µm) show artificially low IOP readings. This is dangerous because if actual IOP is higher than the reading shows, may be at risk for developing glaucoma and the doctor may not know it. Untreated, high IOP can lead to glaucoma and vision loss. It is important that the doctor have an accurate IOP reading to diagnose the risk and decide upon a treatment plan.

Actual IOP may be underestimated in patients with thinner CCT, and overestimated in patients with thicker CCT. This may be important to the diagnosis; some people originally diagnosed with normal tension glaucoma may in fact be more accurately treated as having regular glaucoma; others diagnosed with ocular hypertension may be better treated as normal based on accurate CCT measurement.

With the recent advance in refractive surgery and wide spread of performance of these type of surgeries than in the past, corneal thickness remain a mandatory pre-request for determining if the cornea is of adequate thickness for performing refractive surgery or not, as well as aiding in the choose of the suitable refractive surgery procedure^[3].

The role of the central corneal thickness was brought to the forefront as a confounder of the applanation tonometry. This was stated by professor Goldmann himself, when he first described his tonometer, that the results of his devise were based on central corneal thickness of 520mm and that the accuracy of his devise would vary if the CCT deviated from that value ^[4, 5].

As the intraocular pressure is the corner stone in the diagnoses, management and follow up of glaucoma patients, knowledge of the CCT would be essential to know the validity of IOP readings.

Central corneal thickness may give a clue about the glaucoma prognoses; this was stated by Jimene-Rodriguez and Leon W in

their studies, they noticed that glaucomatous patients classified as having advanced damage in their visual field have significantly lower CCT^[6, 7].

CCT measurement is still not a routine part of eye examinations in Sudan ophthalmic clinics. This study aimed to determine the central corneal thickness of glaucomatous and ocular hypertension Sudanese patients, and to analyze any change in management decisions based on a CCT measurement being revealed to a masked observer.

Material and Methods:

A cross-sectional study was conducted at the ophthalmology clinics of Khartoum state ophthalmic hospitals. Hundred subjects, (50 healthy, 50 glaucomatous patients) were included in the study aged from 18 to 80 years. Glaucomatous patients were classified into 3 groups according to glaucoma severity; (mild, moderate and advanced), and according to the angle measurement into; open angle, narrow angle and closed angle.

Subjects included were those glaucomatous and ocular hypertension patients, with reliable visual fields. Subjects excluded were those with history of ocular trauma, intraocular laser or surgery and patients who had any corneal diseases e.g. keratoconus, corneal opacity and corneal dystrophies.

Patient underwent refraction and then slit lamp examination then funduscopy were carried, followed by measurement of the IOP using Goldmann applanation tonometer then measurement of the CCT using ultrasound pachymetry. Lastly, only glaucomatous patients were subjected to gonioscopy using Goldmann 2 mirror gonio lens for glaucoma severity classification. Grading of the glaucoma severity was been adopted specifically in this study, using Mean deviation (M.D) in Octopus visual field guided by Hoddap-Parish-Anderson criteria in to mild glaucoma, moderate glaucoma and advanced glaucoma.

The CCT measurements were recorded from a seated patient using a non contact ultrasonic pachymeter probe (Pachmate™ DGH 55, DGH Technology Inc, PA) gently placed in the mid-pupillary axis of the cornea in the undilated eye. All measurements were taken by expert technician.

Data analysis:

Data was analyzed using SPSS version 20 software. Means, standard deviations and ranges were calculated for CCT and other variables. Type and severity of glaucoma was evaluated on CCT using independent t test and one way ANOVA test. A p-value of <0.05 was considered significant.

Ethical approval:

Local ethics committee approval was obtained for this study. Measurements were only taken after informed consent was taken.

Results:

This study was carried out in one hundred subjects. They represent 2 main groups: 50 (50 %) patients with glaucoma, compared to 50 (50%) normal subjects as a control group; (Table 1).

Out of the 100 subjects included in this study 41.7% were males and 58.3% were females.

The glaucomatous patients were subdivided into three groups: 39 patients with open angle were (78%), 8 patients with narrow angle (16%), and 3 patients with closed angle glaucoma (6%); (Table 2).

Eyes of glaucomatous patients were classified into three categories according to the level of glaucoma severity, eyes with mild glaucoma were 47(52.3%), while those with moderate glaucoma were 22(24.4%) and those with advance glaucoma were 21(23.3%); (Table 3).

In normal subjects the CCT ranges between 555µm and 597µm and the mean CCT was 538.2±32.1µm, in glaucoma patients the CCT ranges between 445.0µm and 587.0µm and the mean CCT was 510.8±32.4µm. There was a statistical significant correlation between the mean CCT in the 2 groups, (P value = 0.01). (Table 4).

The mean value of the CCT being the thinnest in patients with open angle glaucoma 508.9±29.0 followed by narrow angle glaucoma patients with a mean value of 516.1±48.1, and the thickest being in closed angle glaucoma patients 525.5±27.01. In this study there was a correlation between the type of glaucoma and the mean value of CCT, although it is not statistically significant (p=0.5); (Table 5).

The mean CCT in mild glaucomatous patients was 512.1±30.9µm, while in moderate glaucomatous patients was 505.9±33.1µm and in advanced glaucomatous patients was 512.9±36.0µm. There is no correlation between mean CCT and level of glaucoma severity (p=0.7). (Table 6).

Table 1: Study group distribution:

	Frequency	Percent
Normal	50	50
Glaucoma	50	50
Total	100	100.0

Table 2: Distribution of the glaucomatous group according to the type of angle:

Glaucoma type	Frequency	Percent
Open Angle	39	78.0
Narrow Angle	8	16.0
Closed Angle	3	6.0
Total	50	100.0

Table 3: Distribution of the glaucomatous group according to the stage of severity:

	Frequency	Percent
Mild	47	52.3
Moderate	22	24.4
Advance	21	23.3
Total	90	100.0

Table 4: Mean CCT among study groups:

	Mean CCT±SD
Normal	538.232.1
Glaucoma	510.8±32.4

Table 5: The mean CCT and type of glaucoma:

	Mean CCT±SD
Open Angle	508.9±29.0
Narrow Angle	516.1±48.1
Closed Angle	525.5±27.01

Table 6: The mean CCT and glaucoma severity:

	Mean CCT±SD
Mild	512.1±30
Moderate	505.9±33.1
Advance	512.9±36.01

Figure 1: The mean CCT and type of glaucoma::

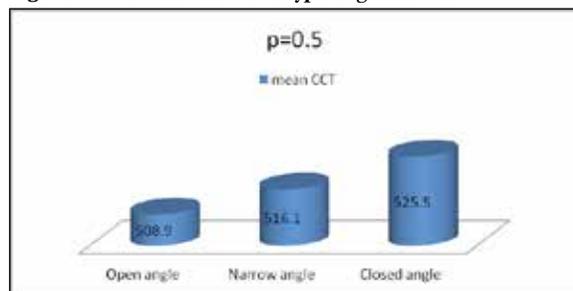
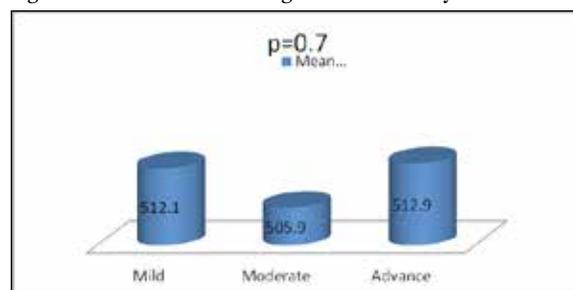


Figure 2: The mean CCT and glaucoma severity:



Discussion:

In comparison of the results of the present study with other international studies in finding the relation between many variables and the CCT, Argus[8] who examined 36 patients with ocular hypertension and compared their central corneal thickness with that measured in 29 control subjects and 31 patients with glaucoma, found that the CCT of eyes of patients with ocular hypertension was significantly thicker than that of the eyes of the normal subjects, while glaucomatous patients had the thinnest mean CCT.

Same finding was found by Herndon [9] and et al who did his study in 184eyes (109 subjects), of which 48 (74 eyes) had glaucoma, 28(51eyes) had ocular hypertension and 33(59eyes) were normal.

This is consistent with the findings of the present study in that the glaucoma group had the thinnest mean CCT($510.8\pm 32.4\mu\text{m}$) than normal subjects ($538.2\pm 32.1\mu\text{m}$) and this relation is statistically significant ($p=0.01$).

In this study, a relationship between the type of glaucoma according to gonioscopy and the mean value of CCT were observed, being thinnest in patients with open angle glaucoma (508.9 ± 29.0), followed by narrow angle glaucoma patients (516.1 ± 48.1) and the thickest in closed angle closure glaucoma patients, ($525.5\pm 27.0\mu\text{m}$), although it is not statistically significant ($P=0.5$).

This may be explained by the increased prevalence of POAG in black whom found to have thin corneas.

However Voogd^[10] found POAG subjects had thin CCT in relation to normal subjects, but most of the international studies comparing between mean CCT in normal tension glaucoma, POAG, and pseudoexfoliation but not between POAG, narrow angle, and closed angle.

This may be explained by the increased prevalence of POAG in black whom found to have thin corneas, while the available data suggests that most Asian population had prevalence for POAG^[11], and their mean CCT measurement is found to be higher than other races.

Rodriguez^[12], studied one hundred and fifty eyes of (150 subjects), divided into three groups: ocular hypertension (35eyes), normal subjects(47 eyes) and glaucomatous (68eyes).The last group was subdivided in three groups depending on the Hodapp-Parish –Anderson criteria for scoring Humphrey visual field defects(initial, moderate and advance).He noticed that patients classified as having advanced damage in their visual field have statistically significant lower CCT thickness ($p=0.01$) than patients with initial damage and moderate damage ($p=0.7$).

Also Leon W^[13], examined one hundred ninety patients (350 eyes), he again noticed a statistically significant relationship between low CCT and worsened advance glaucoma. The present study showed no correlation between the mean CCT and all the subgroups of glaucoma severity. ($p=0.7$), this may be due to our staging system which only depended on mean deviation.

Conclusion:

Adult Sudanese glaucomatous patients had thin CCT in relation to normal subjects.

Patients with open angle glaucoma have the thinnest mean CCT, followed by narrow angle and lastly the closed angle glaucomatous patients.

No correlation between CCT and degree of glaucoma severity.

Recommendations:

- Ophthalmology clinics should be equipped with pachymeters as it help in making the right decision about the diagnoses and follow up of the glaucoma patients, ocular hypertension patients, and sorting confidently glaucoma suspect.
- Further studies are needed to establish the mean CCT in Sudanese subjects, so correcting formulae can be used to avoid under or over estimation of IOP.

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