The effect of diabetes mellitus (type 2) in central corneal and macular thickness and intra ocular pressure IOP

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Abstract

Aim: The aim of the study is to determinate the effect of diabetes mellitus (type 2) in central corneal thickness CCT, central macular thickness CMT and intra ocular pressure IOP. **Material and Methods**: : A case control study was done at Al Faisal Eye Center, Riyadh - Khartoum in period from December 2018 to May 2019.The collected data included the demographic information of diabetic and non-diabetic subjects the examinations carried out were as follow: vision was assessed by a Snellen automated chart projector (Topcon ACP.8), objective refraction was done by Auto Kerato-Refactometer (TOPCON KR-8900), Intra ocular pressure was measured by AT 900 Goldmann tonometer (Haag-Streit international), Central corneal thickness CCT was taken by Ultrasonic Pachymeter (ACCUTOME- AccuPach V-) and central macular thickness was measured by Heidelberg Engineering OCT Spectralis without pupil dilatation .The collected data was analyzed statistically by use of the statistical package for social sciences (SPSS) version 16.0. **Results**: 70 subjects (35 cases of diabetic patients and other 35 subjects of non-diabetic controls) were investigated in this study; 60% males and 40% females but this is unlikely to cause a bias in results because diabetes and its related effects was not found as gender difference, their ages range from 43 to 69. Significant differences were found on the CCT for diabetic patients was (551.7±19.8) which was more than the mean of non-diabetic patients was (538.2±37.7) also p value <0.0001 .Central macular thickness CMT for diabetic subjects mean was (264.7±6.19) which was more than CMT of non-diabetic (254±8.33).There were no statistically significant differences in IOP between diabetic and non-diabetic group p value <0.0001. **Conclusion**: Our finding revealed an increase in corneal and macular thickness in diabetic (type 2) patients compared to non-diabetic group. There were no statistically significant differences in IOP between diabetic and non-diabetic group.

Keywords: Central corneal thickness, central macular thickness, intraocular pressure, diabetes mellitus (type 2)

Introduction

Diabetes mellitus (DM) is one of the most common metabolic diseases that have become epidemic of the 21st century. DM also has significant detrimental effects on the morphology, physiology and clinical appearance of the cornea. Diabetic changes may manifest in the corneal epithelium, basement membrane, stroma and endothelium; this in turn may affect the measurement of intraocular pressure (IOP), causing over-estimation of the true intraocular pressure [(1)].

The macula is part of the retina at the back of the eye. It is only about 5mm across but is responsible for all of our central vision, most of our color vision and the fine detail of what we see. Macular edema is a common cause of visual loss. Abnormal fluid accumulation within the retina and a concomitant increase in retinal thickness usually result from the breakdown of the blood-retinal barrier. This process can be found in those with diabetic retinopathy, retinal vein occlusion, uveitis, and other ocular disorders [(2)].

Macular thickness is increase due to fluid accumulation in the macula in patients with diabetes mellitus. Optical coherence

tomography (OCT) has been shown to be highly reproducible in measuring macular thickness in normal individuals and diabetic patients. OCT can detect subtle changes of macular thickness [3].

Materials and methods

This is a case control study was done at Al Faisal Eye Center, Riyadh – Khartoum Sudan in period from December 2018 to May 2019, the calculated sample size in this study was 70 subjects (35 cases of diabetic subjects and other 35 subjects non-diabetic controls). Patients age and gender was recorded, vision was assessed by a Snellen Automated chart projector (Topcon ACP.8), objective refraction was done by Auto Kerato-Refactometer (TOPCON KR-8900), Intra ocular pressure was measured by AT 900 Goldmann tonometer (Haag-Streit international), Central corneal thickness CCT was taken by Ultrasonic Pachymeter (ACCUTOME- AccuPach V-) and central macular thickness was measured by Heidelberg Engineering OCT Spectralis without pupil dilatation.

Inclusion criteria included the following: diabetic patients (Type 2) having controlled glucose level, healthy patients and diabetic patients with intact eyes (normal ocular heath) and healthy patients and diabetic patients with unaided visual acuity at least 6/60 and visual acuity among 6/9 to 6/6. The collected data was analyzed statistically by use of the statistical package for social sciences (SPSS) version 16.0.

Results

The study was designed to investigate the changes in ocular biometry including; central corneal thickness CCT, central macular thickness CMT and intraocular pressure IOP among diabetic (type 2) patients compared with normal control group.

Table (1) Distribution of DM and NDM subjects according to age

Age	Range	Mean	St.D.
Age of non diabetic subjects	43 – 69	52.6944	7.55861
Age of diabetic subjects	48 – 66	58.4167	4.77119

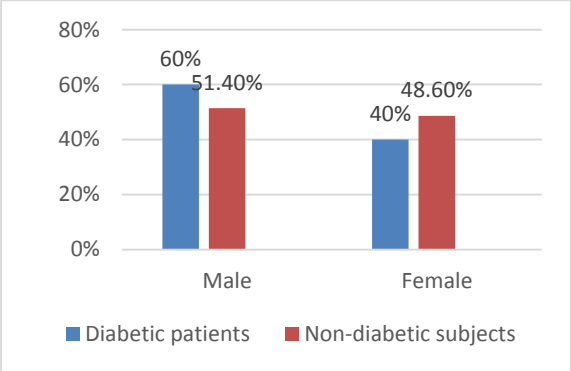

Figure 1. Distribution of DM and Non DM subjects according to gender

Table (2): Demographic data of diabetic and non-diabetic subjects

Data	Diabetic subjects	Non-diabetic subjects
Gender		
Male	21 (60%)	18 (51.4%)
Female	14 (40%)	17 (48.6%)
Refractive error (type)		
Hypermetropic	15 (42.9%)	17 (48.6%)
Myopic	11 (31.4%)	8 (22.9%)
Astigmatic	9 (25.7%)	10 (28.6%)

Table (3): Descriptive statistics of diabetic and non-diabetic subject's right and left eyes

Data	Diabetic subjects Mean ± Std & range		Non-diabetic subjects Mean ± Std & range	
	Right eye	**Left eye**	**Right eye**	**Left eye**
Vision	0.34± 0.168 (0.7 - 0.1)	0.35± 0.159 (0.7 - 0.1)	0.50± 0.274 (1.0 - 0.2)	0.49± 0.273 (1.0 - 0.1)
VA	0.96± 0.143 (1.0 - 0.2)	0.96± 0.063 (1.0 - 0.7)	0.99± 0.016 (1.0 - 0.8)	0.98± 0.032 (1.0 - 0.8)
CCT	551.2±20.44 (440.0 - 567.0)	552.2±19.5 (449.0 - 569.0)	543.9±10.63 (499.0 - 560.0)	532.6±52.10 (259.0 - 561.0)
CMT	265.0±5.58 (250.0 - 274.0)	264.5±6.83 (249.0 - 277.0)	253.5±8.25 (235.0 - 270.0)	254.9±8.45 (232.0 - 271.0)
IOP	14.2±1.76 (12.0 - 18.0)	14.7±1.76 (12.0 - 18.0)	14.6±2.23 (11.0 - 19.0)	14.3±2.40 (10.0 - 19.0)

Table (4): Compression of total eyes of diabetic and non-diabetic subjects

Data	Diabetic subjects Mean ± Std	Non-diabetic subjects Mean ± Std
Total No. of eyes	**70**	**70**
Vision	0.34± 0.163	0.49± 0.272
Visual acuity	0.96± 0.109	0.99± 0.025
CCT	551.7±19.8	538.2±37.7
CMT	264.7±6.19	254.2±8.33
IOP	14.5±1.77	14.4±2.30

Table (5): Compression of total diabetic subjects and non-diabetic subjects

Data	Correlation	P-value	CI at 95%	T-test	P-value
Vision	0.16	0.181	(-0.220 - 0.079)	-4.272	<0.0001
Visual acuity	0.37	0.001	(-0.050 - 0.001)	-2.086	0.041
CCT	- 0.07	0.563	(3.020.23.95)	2.571	0.012
CMT	- 0.007	0.955	(8.058 - 13.02)	8.467	<0.0001
IOP	- 0.119	0.329	(-0.704 - 0.761)	.078	0.938

Discussion

The range of subjects' age was 43-69 years. There were relatively more males than females among participants of the two groups but this is unlikely to cause a bias in results because diabetes and its related effects were not found as gender difference (figure 1). The potential drop of vision in the two groups is significantly due to refractive error. All subjects in this study have shown refractive errors and the majority of which were not corrected. All types of refractive errors were found in this study, but hypermetropia is more dominant among the two groups (table 2). However, correction of refractive error alone would reduce the burden of visual impairment. Many studies shown that the CCT and CMT are

significant affected by refractive errors, so this may be a cause of changes on CCT and MCT beside diabetes.

Visual acuity is the most commonly used test to assess visual function. The Snellen based charts are universally accepted tools for testing visual acuity. A wide range of uncorrected vision has been reported and after correction a significant improvement in visual acuity was scored (tables.3&4). These findings indicate that the contribution of refractive error is high. Therefore, the present results assume that the refractive error was the main source which reduced the visual capability.

There were statistically significant difference in CCT between diabetic and non-diabetic group, Mean of CCT for diabetic subjects was 551.7±19.8 which was more than the mean of non-diabetic subjects was 538.2±37.7, increased thickness of diabetic patients this is due to cellular dysfunction and dysfunctional repair mechanisms which include recurrent erosions, delayed wound healing, ulcers, and edema, although, this difference is not affecting their visual capability. This result agreed with that found by Ozdamar et al, 2010 [4], stated that the cornea of diabetic patients is thicker when compared with non-diabeticpatients. Thicker central cornea associated with diabetes mellitus should be taken into consideration while obtaining accurate intraocular pressure measurements in diabetics [4]. And also agreed with Toygar et al, 2015[5]., stated that CCT is significantly increased in type II diabetes mellitus patients with respect to controls[5].

In this study there were statistically significant difference in CMT between diabetic (the mean was 264.7±6.19) and non-diabetic group (the mean was254±8.33) there was relatively increase thickness among diabetic patients this is due to fluid accumulation in the macula in patients with diabetes mellitus although, this difference is not affecting their visual acuity, but disagrees with Mehmet Demir,Ersin Oba and Efe Can, 2013, stated that central macular thickness was not significantly thicker in patients with type 2 diabetes without clinical retinopathy than in healthy subjects[6].

IOP is highly related to the disease of glaucoma which is one of the most common causes of blindness and visual impairment in the world, especially in the older population. There were no statistically significant differences in IOP between diabetic (the mean 14.5±1.77) and non-diabetic group (the mean 14.4±2.30) p value <0.0001.

Conclusion

This study concluded that diabetic mellitus (type 2) had effect on visual acuity, central corneal thickness and central macular thickness. The results interpreted in terms of statistically significant differences in diabetic patients and non-diabetics control patients. The results revealed significant changes in central corneal thickness (CCT) increase and central macular thickness (CMT) increase in

diabetic type 2 patients when compared with normal patients, and there were no significant difference in intra ocular pressure (IOP) between diabetic and non-diabetic patients.

Recommendations

Diabetic patients get a comprehensive dilated eye examination and at least once a year and maintaining good control of blood sugar helps prevent ocular problems.

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