Sub-Foveal Choroidal Thickness in Diabetics and Non-Diabetics in the Jordanian Population

Mouna M. Al Saad[1] , Osama H. Ababneh [2]

Abstract

Background and Aims: Diabetes is a common disease. The aims of the study was to measure the sub-foveal macular choroidal thickness in diabetics without diabetic retinopathy and to compare it with non –diabetics in a Jordanian population.

Method: The present paper is a retrospective, observational, case series study. Enhanced depth imaging ocular coherence tomography (EDI-OCT) images were obtained from diabetics without diabetic retinopathy and were compared to healthy subjects using a spectral domain OCT. The sub-foveal choroidal thickness was measured from the outer boarder of the retinal pigment epithelium to the inner scleral border at the center area of the foveal depression. Statistical analysis was performed to evaluate the sub-foveal choroidal thickness in eyes without diabetic retinopathy and to compare it with age matched healthy adults.

Results: The present work studied 68 eyes of 38 patients aged between 26 and 79 years. The study consisted of 23 males and 15 females. There were 42 eyes of 21 diabetic patients and 26 eyes of 17 subjects without diabetes. The average sub-foveal choroidal thickness was slightly less in the diabetic group (256±108 μm) compared to eyes without diabetes (265±105 μm), but the difference was not statistically significant (p=0.51).

Conclusion: The present study concluded that patients with diabetes mellitus had a slightly but statistically insignificant thinner sub-foveal choroid thickness than non-diabetics. This finding may indicate that thinning of the choroid may be an early sign of ocular ischemia due to shrinkage of the choroidal vasculature in diabetic patients.

Keywords: choroidal thickness, diabetes, enhanced depth OCT, Jordanian population.

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Introduction

A healthy choroid is important for retinal perfusion and function.[1] Choroidal structure and vascular pattern may be altered in diabetic patient with diabetic retinopathy.[2]

Ocular coherence topography is a recent non-invasive imaging technique that is used to obtain high-resolution image of the retina. With the more recent modality of the enhanced depth imaging (EDI) software technique, the

1.Mouna M. AL Saad: Assistant Professor in Ophthalmology, Ophthalmology Consultant Vitreoretinal Surgeon, Department of Special Surgery, School of Medicine, University of Jordan, Amman, Jordan. PO Box 13301. Postal code 11942. Email: eye_maas@yahoo.com

2.Osama H. Ababneh: Professor in Ophthalmology, Oculoplastic and Orbit surgeon. Department of Special Surgery, School of Medicine, University of Jordan, Amman, Jordan. Email: ababneh99@yahoo.com

choroid can also be visualized with higher resolution[1,3] and in vivo.[4] EDI software automatically captures a cross-sectional image with the choroid close to the zero delay line to maximize sensitivity on the outer limit of the choroid.[1] In addition to that, the manual choroidal thickness measurement is reliable and reproducible when measured from the outer border of the retinal pigment epithelium to the border of choroid stroma.[1,5-6] The reason why the choroidal thickness was not adequately investigated in the past is that the beam was not passed through the retinal pigment epithelium. With the EDI modality, the beam can pass through the sclera. Data exists about abnormalities in the choroidal structure and function related to various ocular abnormalities.[3,7-8] Diabetes causes many pathological changes in the choroid. These changes include vascular tortuosity, focal dilatation, micro aneurysms and focal ischemia. In addition, the variation in choroidal thickness may be related to various disease states and is affected by treatment. An example is that choroidal thickness decrease after intensive diabetic control[9] and after pan photocoagulation laser.[10] However, it is not well known if these variations are the causes or the results of certain diseases.[4] Even with the advances in choroidal measurement using enhanced depth technique with spectral domain OCT, more invasive methods like indocyanine green angiography (ICG) remain the gold standard method to visualize and evaluate the choroid.[11]

Materials and Methods:

A total of 68 eyes from 38 patients visiting the ophthalmology department at the University of Jordan Hospital from March 2017 to September 2017 were examined and included in this retrospective observational case series study. There were 42 eyes of 21 diabetic patients without diabetic retinopathy, and 26 eyes of 17 non diabetics. Both groups were of similar ages and both groups have normal looking retina.

Informed consent was obtained from every patient and a detailed ocular and systemic history was taken. Visual acuity was measured using Snellen chart and refraction was done if needed. Slit lamp examination was performed and intraocular pressure was also measured using Goldman applanation tonometry and a dilated fundus examination.

Exclusion criteria were patients with uncontrolled blood pressure, history of recent cataract surgery (within the last 6 months), history of any intraocular surgery, abnormal looking retina or choroid, any disease that may affect the choroid. Patients with hyperopia more than 3 diopters or myopia more than 6 diopters were also excluded. In addition, subjects with unclear OCT images were excluded.

OCT measurement was done for all patients after pupillary mydriasis using the same OCT machine (Optivue).

A fovea centered 3 mm horizontal line distance was used in choroidal evaluation. Measurement was done perpendicularly from the retinal pigment epithelial layer to the choroid scleral junction and the sub- foveal choroidal thickness was obtained.

Data analysis

Statistical analysis was done using SPSS version 21.0 (Chicago, USA) in our analysis. We used mean (± standard deviation) to describe continuous variables (i.e. age and measurements). We used count (frequency) to describe other nominal variables (i.e. gender and eye). We performed independent sample t-test to analyze the mean difference between

measurements and each of gender and laterality, and we presented data in mean (95% confidence interval CI). We used Pearson's correlation to study the correlation between age and each measurement. All underlying assumptions were met, unless otherwise indicated. We adopted a P value of 0.05 as a significant threshold.

The study had the Institutional Review Board approval and was adherent to the declarations of Helsinki.

Results:

A total of 68 eyes from 38 patients were included in our study. The patients consist of 17 males (45%) and 21 females (55%). Forty-two of the 68 eyes belonged to 21 patients with type 2 diabetes and 26 eyes belonged to 17 patients without diabetes.

The mean age of the diabetic group was 61.2 years old and that for the non-adiabatic group was 58.9 years old, as indicated in Table 1.

Regarding the choroidal thickness, it was slightly less in patient with type 2 diabetes mellitus as compared with the non-diabetic subjects (256±108 μm vs. 265±105 μm), p=0.51. This difference is considered as not statistically significant (Table 2)

Table 1. Patient characteristic by category.

	Number	Age	Males	Females	Right Eyes	Left Eyes
Patients with Diabetes		61.2	13	8	21	21
Patients Without diabetes		58.9	10	7	14	12

Table 2. Choroidal thicknesses by patient category (p=0.51).

Patients Category	Sub-Foveal Choroidal Thickness, μm
Patients with Diabetes	256±108
Patients Without Diabetes	265±105

Discussion:

The present study aimed to compare the sub-foveal choroidal thickness for patients with type-2 diabetes with that of no apparent diabetic retinopathy and in patients without diabetes. It was found that the sub-foveal choroidal thickness was slightly thinner in diabetics as compared to that of the non-diabetics, but the difference was not statically significant.

The present work indicates a negative correlation exists between the age and the choroidal thickness. Spaide[12] reported that the thickness decreases with increasing the age. But in the present study, the age of both groups was similar, so the age factor was eliminated.

Various studies were performed considering choroidal thickness in diabetics with and without diabetic retinopathy and the effect of the treatment. The previous studies showed contradicting results.

A study from India[13] evaluated choroidal thickness in various stages of diabetes in Indian ethnicity. Their study found that the choroidal thickness in subjects with diabetes, but without diabetic retinopathy, was significantly thinner as compared with the non-diabetics. Their study also found that choroidal thinning may contribute to diabetic retinopathy pathogenesis.

The same result was obtained by Galgauskas et al.[14] Their study showed that the

sub foveal choroidal thickness was significantly lower than the control group and there was no difference in age, sex or axial length. It was also concluded that diabetic retinopathy and macular edema did not influence the sub-foveal choroidal thickness significantly.[14]

Similar results were obtained by Gupta et al.[2] They concluded that patients with diabetes had significantly thinner mean choroidal thickness, smaller volume, more inflection points, and lesser choroidal vascular area within the fovea and macula.

On the other hand, other studies showed different results. Kim et al.,[15] reported that the sub-foveal choroid in DME-group eyes was significantly thicker than in non-DME eyes and the thickness increased as the severity of the diabetic retinopathy increases. The same result was obtained by Xu et al.[16] in which the sub- foveal choroid was thicker in diabetics compared to non-diabetics after adjusting the age, region of habitation, body mass index, systolic and diastolic blood pressure and level of education. They also added that the stage of diabetes was not associated with additional abnormal sub-foveal choroidal thickness. The choroidal macular thickness was evaluated in pre-diabetics and it was found that there was a significant positive correlation between all points of macular choroidal thickness with body mass index (BMI), fasting blood sugar and glycosylated hemoglobin. It was also concluded that increased macular choroidal thickness may be the earliest sign to detect the onset of diabetic retinopathy in pre diabetics.[8] Limitations of our study were the sample size which was small and that it was retrospectively collected. In addition, the sample was collected from the University of Jordan Hospital, a tertiary referral center which may not accurately represent all the Jordanian population. However, we believe that this work adds important information in the field of ophthalmology. We recommend similar studies with larger numbers of patients to support our results.

In conclusion, sub-foveal choroidal thickness of diabetic patients before the development of diabetic retinopathy was thinner than in normal subjects. Although that the difference was not statistically significant, choroidal thickness may still serve as an important early indication of diabetic retinopathy, changes may be related to the pathogenesis of diabetic retinopathy or may be related to the treatment.

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سماكة طبقة مشيمة العين لدى المصابين بمرض السكري و لدى غير المصابين عند الشعب الأردني

منى السعد[1]، أسامة حميد عبابنة[2]

1. **أستاذ مساعد في كلية الطب، طب و جراحة العيون، استشاري طب و جراحة الشبكية والسائل الزجاجي، كلية الطب الجامعة الأردنية.**
2. **طب و جراحة العيون، استشاري جراحة تجميل وترميم العيون والجفون ومحجر العين، رئيس قسم الجراحة الخاصة، كلية الطب، الجامعة الأردنية.**

الملخص

الهدف من الدراسة: إنَّ مرض السكري من الأمراض المنتشرة في الأردن، والهدف من الدراسة معرفة إذا كان وجود مرض السكري يؤثر أو يغير من سماكة طبقة المشيمة المركزية قبل وجود تغيرات مرئية على شبكية العين أو ما يعرف بداء الشبكية السكري ومقارنته بسماكة المشيمة عند الأصحاء من أبناء الشعب الأردني.

منهجية البحث: بحث استعادي للأحداث عن سلسلة حالات باستخدام تقنية العمق المحسن لتصوير الشبكية الطبقي، قمنا باستخدام صور المرضى الموجودين واحتساب سماكة طبقة المشيمة المركزية لدى المصابين بمرض السكري قبل وجود تغيرات شبكية سكرية و مقارنتها عند غير المصابين بمرض السكري الطابقين للعمر، وتم قياس السماكة من الحدود الخاجية لطبقة ظهارة الشبكية الصبغية إلى الحدود الداخلية للصلبة عند النقرة المركزية، وتم بعد ذلك إجراء تحليل إحصائي لمعرفة إذا كان وجود مرض السكري لوحده قبل وجود تغيرات شبكية سكرية مرئية يغير من سماكة هذه الطبقة بالمقارنة مع الاصحاء المطابفين للعمر من أبناء الشعب الأردني.

النتائج: شارك في الدراسة 68 عين من 38 مريض كانت أعمارهم محصورة بين 26 إلى79 سنة من بينهم 23 ذكر و 15 أنثى، وتم دراسة42 عين من 21 مصاب بمرض السكري و17 عين من 26 مريض سليم، متوسط السماكة المركزية لطبقة المشيمة لدى مرضى السكري كان أقل بقليل بالمقارنة مع الأصحاء (256+/-108 um)مقارنة بـ(265+/-105)إلا أن الفرق لم يكن له أهمية إحصائية)P=0.51.

الاستنتاج: بينت الدراسة أن سمكة طبقة المشيمة المركزية أقل لقليل عند مرضى السكري مقارنة بالأصحاء إلا أن الفرق لم يكن ذو إحصائية كبيرة، ويمكن الاستنتاج أن حدوث تقص في سماكة طبقة المشيمة ربما يكون مؤشراً مبكراً لوجود نقص تروية لشبكية العين قبل حدوث تغيرات سررية مرئية، وذلك بسبب حدوث ضمور في الشعيرات الدموية المكون الأساسي لمشيمة العين بسبب مرض السكري.

الكلمات الدّالّة:سماكة المشيمة، مرض السكري، الشعب الأردني، التصوير المقطعي محسن العمق.

الاستنتاج: بينت الادراسة ان سمكة طبقة المشيمة المركزية اقل لقليل عند مرضى السكري مقارنة بالاصحاء الا ان الفرق لم يكن ذو احصائية كبيرة. يمكن الاستنتاج ان حدوث تقص في سماكة طبقة المشيمة قد يكون مؤشر مبكر لوجود نقص تروية لشبكية العين قبل حدوث تغيرات سررية مرئية وذلك بسبب حدوث ضمور في الشعيرات الدموية المكون الاساسي لمشيمة العين بسسب مرض السكري.

الكلمات الدّالّة: سماكة المشيمة، مرض السكري، الشعب الأردني، التصوير المقطعي محسن العمق