Measurement of Choroidal Thickness in Atrial Fibrillation

Atrial Fibrilasyonda Koroid Kalınlığı Ölçümü

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ABSTRACT

Purpose: To investigate whether Atrial Fibrillation (AF) affects the choroidal thickness.

Method: 57 eyes of 30 AF patients and 59 eyes of 30 volunteer examined in our eye clinic for different reasons were included in our study. Choroid thickness was measured at the fovea, at points 1mm temporal to the fovea, and at points 1 mm nasal to the fovea in a horizontal section. The mean choroidal thickness of the two groups was compared.

Result: There was no statistically significant difference for age and gender between two groups (p= 0,07, 0,796 respectively). The mean choroidal thicknesses in nasal, temporal submacular and the subfoveal region was lower in AF group for both eye separately. In each group, there was no significant difference between right and left eye for nasal submacular, temporal submacular and subfoveal choroidal thickness.

Conclusion: Choroidal thickness of AF patients is thinner compared to control group. This effect may be the result of the microvascular effect of AF.

Keywords: Atrial fibrilation, choroidal thickness, endothelial dysfunction.

ÖZ

Amaç: Atrial fibrilasyonun(AF) koroid kalınlığını etkileyip etkilemediğinin araştırılması.

Gereç ve Yöntem: 30 AF hastasının 57 gözü kliniğimize değişik nedenlerle gelmiş 30 gönüllünün 59 gözü çalışmaya dahil edildi. Koroid kalınlığı foveadan, foveanın 1 mm temporal ve nazalinden ölçüldü. İki grubun ortalama koroid kalınlığı ölçümü karşılaştırıldı. Gruplar arası koroid kalınlıklarını karşılaştırmak için Nonparametrik Mann-Whitney U testi kullanıldı. 0,05 altındaki değerler anlamlı olarak kabul edildi.

Bulgular: Yaş ve cinsiyet açısından iki grup arasında istatistiksel anlamlı fark izlenmedi (sırayla . p = 0,07, 0,796). Heriki gözde ayrı ayrı nazal-temporal submakuler ve subfoveal alanda koroid kalınlığı AF grubunda daha ince bulundu. Her grupta sağ ve sol gözler nazal-temporal submakuler, subfoveal koroid kalınlıkları açısından anlamlı fark izlenmedi.

Tartışma: AF hastalarında kontrol grubuna göre koroid kalınlığı daha ince bulundu. Bu sonuç AF nin mikrovasküler etkilerine bağlı olabilir.

Anahtar sözcükler: Atrial fibrilasyon, koroid kalınlığı, endotelyal disfonksiyon.

INTRODUCTION

Atrial fibrillation (AF) is the most common type of chronic arrhythmias.[1,2] It is a heart rhythm disorder and associated with thrombus formation in the atrium and increased risk of embolization causing complications such as stroke and heart failure. Additionally, the disturbance of heart rhythm and impaired blood flow dynamics can cause vascular damage. All these effects can lead to decrease blood supply to peripheral tissues resulting in ischemia.

There are studies reporting thrombosis and vascular endothelial damage due to AF in the literatüre.[3,4] In a study authors found that Raised C Reactive Protein (CRP) in circulation was correlated with the left atrial thrombus formation in non-rheumatic atrial fibrilation.[5] Khalil et al. found microalbuminuria as the strongest predictor for AF development in hypertensive patients.[6] In a study investigating the risk factors for atherosclerosis development in AF, it was determined that blood CRP elevation and

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microalbuminuria association were fourfold correlated with AF.[7]

Choroid is a microvascular structure supplying the outer retina. It can be affected any ocular and sytemic disorders affecting vascular system. Studies investigating the relationship between choroid and ocular-extraocular diseases such as diabetic retinopathy, age-related macular degeneration, uveitis, retinal vaso-occlusive diseases and systemic diseases lilke familial mediterranean fever, alzheimer, scleroderma, iron deficiency were performed.[8-14]

In our study, we aimed to investigate whether AF affects the choroidal tissue that is a microvasculature which can be affected by systemic problems.

METHOD

Patient Selection and Study Design

This cross-sectional study was performed at Opthalmology and Cardiology Clinics in Pamukkale University Hospital. The study was approved by the Institutional Review Board of Pamukkale University, School of Medicine. The study was conducted in accordance with the Helsinki Declaration. 57 eyes of 30 AF patients and 59 eyes of 30 controls which were examined in ophthalmology clinic for different reasons were included in our study. Detailed eye examination of the patients was performed.

Exclusion Criteria

Patients having previous ocular injury, refractive errors between -3 and +3 glaucoma, uveitis, retinal diseases, dens lens opacity, glaucoma, history of previous ocular surgery, laser therapy, was excluded.

OCT Measurement

The choroid thicknesses were measured by Enhanced Depth Imaging (EDI) using OCT (Spectralis OCT Heidelberg Engineering,Dossenheim, Germany). The choroid thickness was accepted as the distance between the outer surface of the hyperreflective line and the inner sclera border. The scan was measured at the fovea, at points 1mm temporal to the fovea, and at points 1 mm nasal to the fovea in a horizontal section.(Figure1)

Statistical Analysis

All statistical analyses were performed by SPSS21software (IBM Corporation, Armonk, NY, USA). Nonparametric Mann-Whitney U test was used to compare choroidal thickness between groups. Regression analysis was performed to find the independent effect of atrial fibrillation. Values < 0.05 were considered as significant.

RESULTS

There was no statistically significant difference for age and gender between two groups (p= 0,07, 0,796 respectively). When we compared two groups for the presence of systemic diseases, there was a numerical difference between the two groups, but statistical significance was not measured because some numbers of variables in the groups were considered inadequate (Table1).

In each group, there was no significant difference between

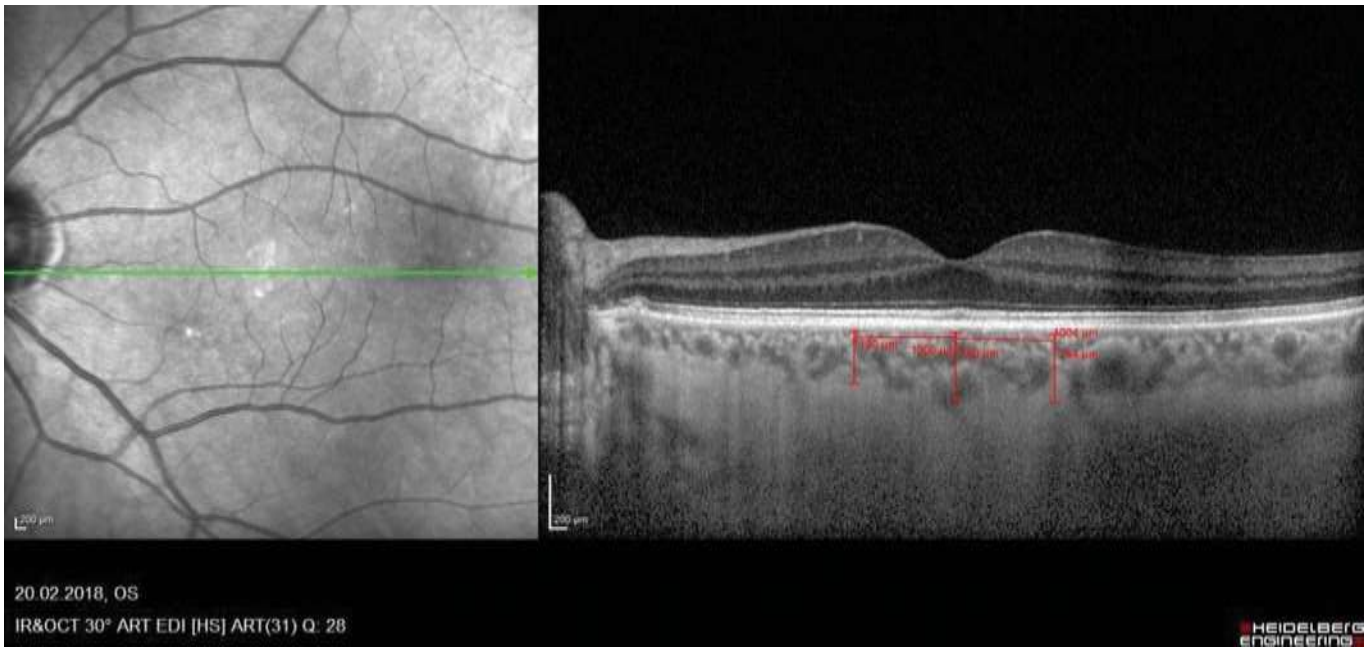

Figure 1. *Measurement of choroidthicnesses by EDI OCT.*

Table 1. *Comparison of demographics*			
	AF (n=30)	Kontrol (n=30)	**p**
Age(ort.)mean±SD	67,60±10.29	63,57±5,98	0,07
Gender			0,796
Male	15	16	
Female	15	14	
Systemic Disease			
HT	12	6	
DM	10	4	
More than one	5	3	
HT: Hypertension DM: Diabetes Mellitus			

right and left eye for nasal submacular, temporal submacular and subfoveal choroidal thickness (Table2).

The mean choroidal thicknesses in nasal, temporal, submacular and subfoveal region was less in AF group for both eye separately (Table2).

There are risk factors such as hypertension and diabetes in the AF group that can affect the choroidal thickness. Regression analysis showed that atrial fibrillation independently affects choroidal thickness regardless of hypertension and diabetes (Table3).

Table 2. *Comparison of choroidal thickness in each group and between two groups*			
	Rigt	Left	p
Nasal Submacular	mean±SD	mean±SD	
AF	217,79±75,10	207,03±61,93	0,572
Control	279,76±90,63	294,24±84,21	0,430
p	0,003	0,001	
Temporal Submacular			
AF	228.79 ±54,95	228,57±53,89	0,486
Control	289,26±83,45	293,51±593,85	0,812
p	0,001	0,002	
Subfoveal			
AF	225,10±53,22	227,46±57,88	0,670
Control	296,70±86,04	310,89±102,22	0,279
p	0,001	0,001	

Table 3. *Regression analysis of variables*				
	R^2	Beta	CI	p
Nasal Submacular	178	-0,422	-124,28 - -31,89	0,001
Temporal Submacular	194	-0,441	-96,74 - -27,19	0,001
Subfoveal Submacular	212	-0,460	-117,82 - -36,04	<0,001

DISCUSSION

Microvascular structure in the body can be affected by hemodynamic instability in AF. Irregularity in heart rate can disturb vascular endothelial structure in AF. On the other hand, AF and atherosclerosis as a result of vascular injury have common features too.[15,16] All these findings show the relation between vascular injury and AF.

Minamino et al. found endothelial dysfunction in AF patients compared with sinus rhythm[17]. In 2001, Takahashi et al. Found that beat-to-beat variations in cardiac cycle length, stroke volume, and change in flow velocity produce turbulent shear stress and disruption of endothelial functions in patients with AF. [18]

To show the effect of impaired hemodynamics on choroid thickness, there are studies investigating cardiovascular diseases and choriod thickness. The relation of systemic hypertension and choroidal thickness was investigated and lower choroid thickness was found in hypertensive patients with compared to control subjects.[19,20]

Ahmad et al. compared the choroid thickness of patients with coronary artery diseases (CAD) to healthy control group, and found that choroid thickness was thinner in CAD group.[19]

Ahn et al. investigated choroidal thickness in hypertensive retinopathy and found that subfoveal choroid thickness (SFCT) is correlated with blood pressure.[21]

Altinkaynak et al. compared SFCT between chronic heart failure and age and sex match healthy control and found thinner in patient group.[22] As a result, impaired hemodynamics can affect choroidal tissue.

In our study, choroid thickness was thinner in AF patients compared to the control group.So we performed a regression analysis to show the independent effect of AF on the choroid. We found a negative effect of AF on choroidal thickness independently. This result could be the effect of increased thrombogenesis and endothelial damage due to AF. So we performed the analysis of the eyes separately. Because we think that thrombosis as a result of AF can affect the choroid nonsymmetrically. But there was no significant difference between right and left eyes of the patients. It makes us think that endothelial damage could be the main reason for choroidal thinning.

In conclusion, choroidal thickness of AF patients is thinner but there was no difference between right and left eye of patients. So endothelial damage may be the main reason. To our knowledge, there is no study on this issue in the literature. Further studies are needed on this topic in the future. Measurement of choroidal thickness which is a noninvasive and easily performed in AF can be used in clinical follow-up of patients and following microvascular complications of the disease after publications supporting our study.

Limitations of the Study

The number of patients included in the study is low. So we could not create subgroups in AF group to investigate the effect of drugs used by patients and systemic diseases on choroidal thickness.

Declaration of interest

Authors state that there are no conflicts of interest.

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