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Araştırma Makalesi

Kronik Valsalva Manevrasının Ön Kamara Parametreleri ve Koroid Kalınlığı Üzerine Etkileri

Effects of Chronic Valsalva Maneuver on Anterior Chamber Parameters and Choroidal Thickness

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ÖZET

Amaç: Çalışmamızın amacı, göze akut etkileri iyi bilinen Valsalva manevrasının (VM) kronik etkilerini ortaya çıkarmaktır.

Materyal ve Metot: Bu kesitsel çalışmaya 25 hastanın 50 gözü ve 30 yaş ve cinsiyet uyumlu sağlıklı bireyin 60 gözü dahil edildi. Tüm hastalara tam bir oftalmik muayene yapıldı. Kornea topografisi ile santral kornea kalınlığı, iridokorneal açı (IKA) ve ön kamara derinliği yapıldı. Spektral alan optik koherens tomografi koroid kalınlığını (KK) ve retina sinir lifi kalınlığını değerlendirmek için kullanıldı.

Bulgular: 25 hasta çalışma grubu ve 30 hasta kontrol grubu vardı. Göz içi basınçları çalışma grubunda 18,31 (std 2,64), kontrol grubunda 15,63 (std 2,14) idi ve bu fark istatistiksel olarak anlamlıydı. (p <0.001) IKA çalışma grubunda 40.30 (std 5.84), kontrol grubunda 45.15 (std 5.51) bulundu ve bu fark istatistiksel olarak anlamlıydı. (p = 0.001) Subfoveal KK çalışma grubunda 273.71 (std 39.35), kontrol grubunda 256.71 (std 20.48) olarak saptandı ve bu fark istatistiksel olarak anlamlıydı. (p = 0.005).

Sonuç: Bu çalışma, VM'nin sık tekrarlanmasının kalıcı etkilerini araştıran ilk çalışmalardan biridir. Sonuç olarak kronik VM'ye maruz kalan hastalarda GİB ve KK'nın arttığını ve İKA'nın azaldığını bulduk.

Anahtar Kelimeler: Valsalva manevrası, göz içi basıncı, iridokorneal açısı, koroid kalınlığı.

ABSTRACT

Aim: The aim of our study is to reveal the chronic effects of Valsalva maneuver (VM), whose acute effects on the eye are well known.

Materials and Methods: A total of 50 eyes from 25 patients and 60 eyes from 30 age-matched and gender-matched healthy individuals were included in this cross-sectional study. A complete ophthalmic examination was performed for all patients. The central corneal thickness, iridocorneal angle (ICA) and anterior chamber depth were performed with the corneal topography. The spectral-domain optical coherence tomography was used to evaluate choroidal thickness (CT) and retinal nerve fiber thickness.

Results: There were 25 patient study group and 30 patient control group. Intraocular pressures were 18.31 (std 2.64) in the study group and 15.63 (std 2.14) in the control group, and this difference was statistically significant. (p <0.001) The ICA was found to be 40.30 (std 5.84) in the study group and 45.15 (std 5.51) in the control group, and this difference was statistically significant. (p = 0.001) The subfoveal CT was determined as 273.71 (std 39.35) in the study group and 256.71 (std 20.48) in the control group, and this difference was statistically significant. (p = 0.005).

Conclusion: This study is one of the first studies investigating the permanent effects of frequent repetitions of the VM. As a result, we found that IOP and CT increased and the ICA decreased in patients exposed to chronic VM.

Keywords: Valsalva maneuver, intraocular pressure, iridocorneal angle, choroidal thickness.

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INTRODUCTION

Constipation is used to define a kind of symptoms, including hard stools, infrequent bowel movements, excessive straining abdominal pain and bloating. Patients need to perform a long-term Valsalva maneuver during defecation. Constipation is defined as acute if it is less than 1 Week in duration and chronic if it is more than 3 months. Most often, chronic constipation occurs as a result of dietary factors such as insufficient fiber intake, lifestyle factors such as lack of mobility or sedentary lifestyle, or primary impairment of bowel function due to colon drive or rectal ejaculation disorder. (1) Chronic constipation is widespread (2) and has negatively affects the quality of life (3). It is a important burden on health-care resources (4). It may be causes psychological distress and it can cause damage to far organs such as the eye. (5) The natural history of constipation is not known.

Valsalva Maneuver (VM) is defined as a strong expiration attempt against a closed airway. VM has four stages. 1 stage; In the first 5 seconds of the VM, the pressure rises in the chest. Stage 2; Venous return to the heart decreases and cardiac output decreases from 5 seconds to 14 seconds. 3rd stage; With the release of the glottis, intrathoracic pressure decreases and venous return increases. 4th stage; cardiac output increases. The reduced cardiac output and hypotension in the strain phase of the VM causes reflex tachycardia and peripheral vasoconstriction. (6) We constantly make the VM during normal daily activities, and this bring along diverse physiological changes, such as increased intrathoracic pressure, elevated blood pressure, stimulation of the peripheral sympathetic system and increased peripheral venous pressure.(7,8) VM can cause changes in ocular vascular structures. It can also be affected secondary to changes in the cornea, ocular vascular structures and anterior chamber, a non-vascular structure. VM has been shown to temporarily increase IOP during daily activities such as weight lifting and isometric exercises.(9-11)

The studies demonstrated increase in IOP throughout VM (12,13). The pathophysiology of IOP increase are not fully understood. As well as the vascular structures of the eye, the cornea which a non-vascular structure, can be affected secondary to changes in the ocular vascular structures and anterior chamber. In a study by Wang et al, It was shown that central corneal thickness decreased, lens thickness and pupil diameter increased during VM. (14) Recent studies have demonstrated using ultrasound biomicroscopy that an increase in uveal thickness causes significant retraction and narrowing of the anterior chamber angle. This situation is thought to cause a temporary increase in IOP. (15,16)

Almost all of the studies conducted to date have been conducted on healthy volunteers and the acute effects of VM have been examined. Our aim in our study was to investigate whether the changes in the acute phase of VM become permanent with continuous repetition of VM. As far as we know, our study is one of the first studies to examine the chronic effects of VM on both the anterior segment and the posterior segment.

MATERIALS AND METHODS

This prospective observational study was performed in the Department of Ophthalmology at Education and Research Hospital. The study was conducted in accordance with the ethical principles of the declaration of Helsinki and was approved by the Institutional Ethical Committee.

The study included patients with constipation who came to the general surgery outpatient clinic of our hospital and whose complaints continued for more than 3 months. The reason these patients were chosen was because they needed to perform a constant and challenging Valsalva maneuver for defacation. All patients received both written and oral information about study, and each patient provided written informed consent. All patients underwent an opthalmic examination including slit lamp biomicroscopy, autorefractometer measurement (TONOREF ™ III, Nidek, Japan), air puff tonometer, and fundus examination. Exclusion criteria were history of systemic disease, ocular surgery and ocular disease except mild refractive errors. Systemic diseases that could effect choroid (such as hypertension, diabetes mellitus, rheumatologic disorders) are excluded for all patients. Pregnancy, any menstural irregularity or oral contraceptive use is also in exclusion criteria. No one with refractive errors between -6.00 and +3.00 diopters (D) spherical equivalent was included in the study.

The central corneal thickness (CCT), iridocorneal angle (ICA) and anterior chamber depth (ACD) were performed with the corneal topography (Sirius, CSO, Florence, Italy). The pachymetry value was accepted as the central (apex) corneal thickness. The ACD was accepted as the depth from the endothelium of the corneal apex to the anterior lens surface.

Enhanced depth imaging optical coherence tomography (EDI-OCT) mode of the spectral-domain optical coherence tomography (Optovue Inc. Freemont, CA) was used to evaluate choroidal thickness. For the choroidal thickness, the distance from the exterior of the high reflective layer corresponding to the sclerocoroidal interface to the retinal pigment epithelium (RPE)/Bruch reflective complex was measured. Average choroidal thickness values were taken at 09.00 am in order not to be affected by diurnal fluctuation. All measurements were recorded by a single experienced person, blinded, averaging three different measurements. Only subfoveal choroid thicknesses were examined to minimize user error and ensure standardization. We measured the average retinal nerve fiber thickness with the same device. We performed all examinations in the morning, while the participants were in a sitting position, following standard

operating procedures. By ensuring that all examinations were non-contact, the effect of measurements on eye parameters was limited.

In our study, intraocular pressure, choroidal thickness, and iridocorneal angle were selected as primary outcomes to calculate the sample size. Group sample sizes of 41 and 41 were determined using a two-sided Mann-Whitney test to detect a difference of 1.0 between group means with known group standard deviations of approximately 1.9 and a significance level (alpha) of 0.050. achieves 81% power: the true distribution is even.

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS)version 23.0 for Windows (SPSS Inc., Chicago, IL. The normality of the data distribution was evaluated by the Shapiro-Wilk test. An independent t-test test was used to compare the mean of numeric variables between the two groups. The p-value was statistically significant at 0.05 or smaller

RESULT

50 eyes of 25 (15 F / 10 M) patients with constipation and 60 eyes of 30 (18 F / 12 M) healthy volunteers were included in the study. The mean age of the study group was 43.25 (std 10.45), and the mean age of the control group was 44.65 (std 12.19). Intraocular pressures of the patients were 18.31 (std 2.64) in the study group and 15.63 (std 2.14) in the control group, and this difference was statistically significant. (p <0.001) Demographic characteristics and ophthalmic examination findings are shown in table 1.

Table 1. Demographic and ophthalmological examination findings of patients

	Grup	N	Mean	Std. Deviation	P
otoref_sfer	Control group	60	-,3409	1,52030	0.061
	Patient group	50	,2212	1,37970	
otoref_silindir	Control group	60	-,6136	,81315	0.210
	Patient group	50	-,9740	1,73799	
IOP	Control group	60	15,6364	2,14683	<0,001
	Patient group	50	18,3154	2,64970	

IOP: intraocular pressure

In the anterior segment measurements, the irido corneal angle was found to be 40.30 (std 5.84) in the study group and 45.15 (std 5.51) in the control group, and this difference was statistically significant. (p = 0.001) There was no significant difference CCT and ACD measurements. In the posterior segment measurements, the subfoveal choroidal thickness was determined as 273.71 (std 39.35) in the study group and 256.71 (std 20.48) in the control group, and this difference was statistically significant. (p = 0.005) There was a mild positive correlation between duration and central choroidal thickness (p: 0.039, r: -0.288). No significant difference was found in the average retinal nerve fiber thickness. (table 2)

Table 2. Comparison of anterior and posterior segment parameters

	Grup	N	Mean	Std. Deviation	P
CCT	Control group	60	520,5085	32,23372	0.346
	Patient group	50	514,8077	30,95097	
ACD	Control group	60	3,0067	0,29953	0.091
	Patient group	50	2,9120	0,28231	
CT	Control group	60	256,9615	20,48157	0.005
	Patient group	50	273,7167	39,35109	
RNFLmean	Control group	60	99,7667	7,73801	0.069
	Patient group	50	97,7308	2,17035	
Angle	Control group	60	45,1538	5,51139	0.001
	Patient group	50	40,3051	5,84647	

CCT: central corneal thickness ACD: anterior chamber depth CT: choroidal thickness RNFLmean: retinal nerve fiber thickness

DISCUSSION

During the Valsalva maneuver, the reflection of the increased intrathoracic pressure on the eye causes changes in the eye parameters. (17,18) In almost all of these studies, the patients underwent voluntary Valsalva maneuver and the acute effects immediately afterwards were examined. After the acute effect has passed, eye parameters return to resting values. As far as we know, our study is one of the first studies to examine chronic changes in eye parameters as a result of frequent repetition of the Valsalva maneuver. Studies have found that VM affects intraocular pressure, choroidal thickness and iridocorneal angle in the acute period.

Researchers reported that the Valsalva maneuver can cause increases in intraocular pressure (IOP) of up to 10 mm Hg. (8,12) One of the hypotheses related to the increase in IOP is that the increase in systemic venous pressure causes a decrease in venous flow in vortical vessels and a corresponding increase in choroidal volume and IOP. (19) In a study conducted by Schuman et al. Using ultrasonic biomicroscopy (UBM), researchers reported an increase in ciliary body and iris thickness in patients who performed VM while playing high-resistance wind instruments. The authors thought that this increase in uveal thickness might lead to an increase in IOP. (15) In addition, mydriasis and ciliary body / iris thickness increases caused by increased sympathetic activity in VM contribute to the closure of the angle and increase in IOP. In our study, we found that IOP was significantly higher in the study group, and the iridocorneal angle was significantly narrower. This situation made us think that changes in the acute period may be permanent in recurrent VM.

There are two hypotheses explaining the increase in choroidal thickness. The first of these is the hypothesis that choroidal thickness increases as a result of choroidal vascular ponding. As a result of increased intrathoracic pressure during VM, blood returns less from peripheral vessels to the heart and peripheral vascular ponding occurs. Vortical ponding occurs in the eye and the choroidal thickness increases. (6) The

second hypothesis is the vasodilation hypothesis. In healthy individuals, the oxygen demand of the retina is tightly regulated. The outer two-thirds of the retina are supplied by the choroidal vasculature. In addition, a significant positive correlation was observed between retinal vessel oxygen saturation and peripapillary choroidal thickness (20). Therefore autoregulation of choroidal blood flow is very important. There are limited studies evaluating the autoregulation of choroidal and retinal blood flow. Ocular blood flow and changes in ocular vascular structure in pathological and physiological conditions affecting systemic blood pressure have not been fully explained. Since the retina consists mainly of nerve cells, we can expect a similarity between the autoregulation of cerebral and retinal blood flow. When mean arterial pressure drops, cerebral blood flow remains constant through the dilation of the diameter of the precapillary vessels. Based on this similarity, vasodilation occurs in choroidal vessels secondary to hypoxia in VM, choroidal thickness increases and retinal oxygenation is provided. (21) In a study conducted by Xingyi et al., volunteers had VM performed and choroidal thickness was examined, and no difference was found between the resting state. (22) On the other hand, in the study of Cicek et al., choroidal thickness after VM was found to be thicker than resting measurements. (21)

In our study, we found the choroidal thickness thicker in the study group. In addition, we found a mild positive correlation between the duration of chronic constipation and choroidal thickness. Chronic constipation patients frequently perform daily Valsalva maneuvers. This can have effects on the circulatory system and even choroidal circulation. We can assume that recurrent VM, as a result of frequent acute increases in intrathoracic venous pressure, may lead to an adaptation of choroidal vessels and an increase in choroidal thickness.

Our study had some limitations. We had relatively few patients. In order to be able to say that VM has chronic effects, we think that patients with chronic VM should be studied in larger series. All measurements were made at the same time in the morning. Before the measurement, the patients were told not to do VM and it was assumed that the patients did not do VM before the measurement. In this case, it is one of the partial limitations of our study. Our study was conducted on patients with chronic constipation. We think that patients who receive constipation treatment and recover should be followed up in the long term whether these parameters improve or not

CONCLUSION

As a result, we found that IOP and choroidal thickness increased and the iridocorneal angle decreased in patients exposed to chronic VM. This situation is important in terms of suggesting that VM, which has acute effects in the eye, may have chronic effects on the eye as a result of frequent recurrence. We think that our study should be supported with larger series and more comprehensive studies.

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Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors. Instution review board/Ethics Committee has approved the study

Informed Consent: Informed consent was obtained from all individual participants included in the study. The article has not been presented in any conference or meeting

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