Does Intraocular Pressure Change During Invasive Coronary Angiography?

Girişimsel Koroner Anjiyografi Sırasında Göz İçi Basıncı Değişir mi?

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ABSTARCT

Purpose: To assess the intraocular pressure (IOP) changes during invasive coronary angiography (ICA).

Materials and Methods: Twenty-seven eyes of 27 patients underwent elective coronary angiography due to various conditions were included in this study. IOPs and mean arterial blood pressures (MBP) were measured before (IOP1, MBP1), during (IOP2, MBP2) and after (IOP3, MBP3) ICA procedure.

Results: 15 male, 12 female patients were prospectively recruited and mean age of patients was 65.5±6.7 years. MBP1, MBP2 and MBP3 values were 112±18.7 mmHg, 108.5±13.4 mmHg and 109.4±12.2 mmHg, respectively. No statistically significant change was detected between MBP values (p>0.05). Mean IOP1, IOP2 and IOP3 values were 18.3±3.7 mmHg, 18.5±.4.2 mmHg and 18.0±3.3 mm-Hg, respectively. A slightly increase in IOP during the procedure was identified, but it was not statistically significant (p>0.05).

Conclusions: Invasive coronary angiography is a safe procedure in terms of IOP fluctuations in individuals without any eye disease.

Key Words: Intraocular pressure, invasive coronary angiography, glaucoma.

ÖZ

Amaç: Invazif koroner anjiyografi (İKA) sırasında göziçi basıncı (GİB) değişikliğini değerlendirmek.

Gereç ve Yöntem: Çeşitli koşullar nedeniyle elektif İKA yapılan 27 hastanın 27 gözü çalışmaya dahil edildi. GİB ve ortalama kan basınçları (OKB) İKA işleminden önce (GİB1, OKB1), İKA işlemi sırasında (GİB2, OKB2) ve İKA işleminden sonra (GİB3, OKB3) ölçüldü.

Bulgular: Hastaların 15'i erkek, 12 kadındı. Ortalama yaşları 65.5±6.7 yıldı. OKB1, OKB2 ve OKB3 değerleri sırayla 112'si±18.7 mmHg, 108.5±13.4 mmHg ve 109.4±12.2 mmHg tespit edildi. OKB değerleri arasında istatistiksel olarak anlamlı bir değişiklik tespit edilmedi (p>0.05). IOP1, IOP2 ve IOP3 değerleri sırayla 18.3±3.7 mmHg, 18.5±4.2 mmHg ve 18.0±3.3 mmHg tespit edildi.İşlem sırasında ortalama GİB'nda hafif artış izlense de bu artış istatistiksel olarak anlamlı değildi (p>0.05).

Sonuç: İnvaziv koroner anjiyografi herhangi bir göz hastalığı olmayan bireylerde GİB dalgalanmaları açısından güvenli bir yöntemdir.

Anahtar Kelimeler: Göz içi basıncı, girişimsel koroner anjiografi, glokom.

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INTRODUCTION

Glaucoma, a multifactorial optic neuropathy, causes vision loss as a result of progressive optic nerve degeneration and commonly occurs in the elderly. It is the second most common cause of vision loss worldwide and the prevelance of the disease ranges 1% to 5 at the population over 40 years old.[1,2] The most important risk factors for the disease are elevated intraocular pressure (IOP) and old age.[3] Invasive coronary angiography (ICA) has been a clinical tool for more than five decades.[4,5] Despite the development of other imaging techniques, including computerized tomography (CT) and magnetic resonance imaging (MRI), selective (i.e, catheter-based) radiographic ICA still remains the most commonly performed method for imaging of the entire coronary tree.[6-8]

Systemic complications of ICA (i.e thromboembolysm, coronary dissection, hemorhage) are defined,[9] however recent literature on ophthalmic concern is limited. The risks of glaucoma and coronary arterial disease increase with increasing age. ICA procedure is especially carried out in elderly patients and it is prone to changes in hemodynamic parameters. Therefore, we aimed to observe the changes in IOP values in patients without any underlying glaucomatous disorder during the ICA procedure.

MATERIALS AND METHODS

Elective ICA planned patients were referred to our clinic by cardiologists before the procedure. Of the 27 referral patients, 15 male (55.6%) and 12 female (44.4%); 27 eyes of 27 patients were included in this study. The study protocol was approved by the Medical Ethical Committee with consideration of the principles of the Helsinki Declaration. All participants provided written informed consent.

All participants had a detailed ophthalmic examination, including determination of visual acuity, refraction, biomicroscopy, IOP measurements (by Tono-Pen®XL applanation tonometer Reichert Inc, Depew, NY, USA), gonioscopy, dilated fundoscopy, central corneal thickness (CCT) measurement (by OcuScan® RxP Ophthalmic Ultrasound System; Alcon, Irvine, CA, USA), and automated perimetry (by Octopus 900; Haag Streit, Koeniz, Switzerland). Patients with previous coronary interventions, low left ejection fraction, pacemaker implant, a history of coronary artery disease, arrhythmia, myocardial infarction, angina were included the study. Patients with diabetes mellitus, renal failure, thyroid or parathyroid dysfunction, glaucoma, CCT >650 or <450 µm, angle closure, angle anomaly, previous ocular surgery or trauma history, and corneal disorders effecting IOP measurement were excluded.

ICA Procedure: A compound needle with inner cannula was inserted to the femoral artery. After the placement of needle in lumen of artery inner cannula was removed. Guide wire was advanced through the needle into the artery. Then needle was removed. The catheter was positioned in the coronary arteries and contrast medium was injected and filled the coronary arteries. All procedures were done by the same cardiologist (YC), and within 8-12 am.

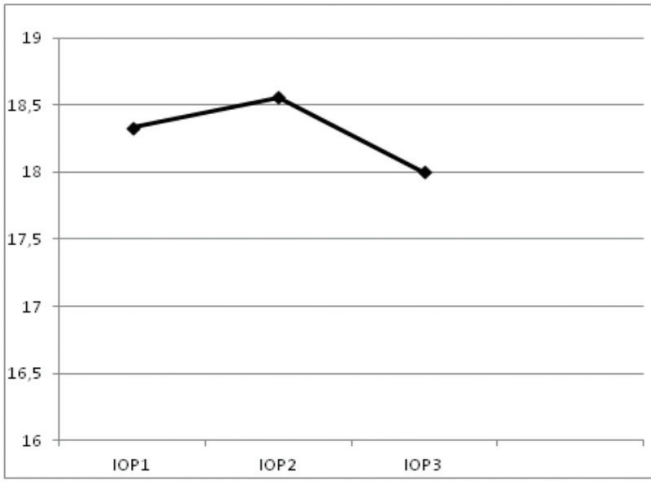
IOP and Blood Pressure Measurements: IOP measurements of right eye were performed just before ICA (IOP1), during ICA (IOP2) and at stationary room immediately after ICA (IOP3). Systolic and diastolic arterial blood pressures were also measured on the right hands at the same times, and were recorded as MBP1, MBP2 and MBP3, respectively. All measurements were performed while patients were supine position.

Statistical analyses were performed using version 16.0 of the SPSS software package for Windows. The results were expressed as means±standard deviations. Kolmogorov-Smirnov tests were used to determine whether variables were distributed normally. Repeated measures ANOVA test was used to compare the variables among the three measurements. An overall p value of less than 0.05 was considered as a statistically significant result. When an overall significance was observed, post-hoc tests were performed using Bonferroni's test. Pearson correlation coefficients were calculated to evaluate relations between the IOP and MBP values.

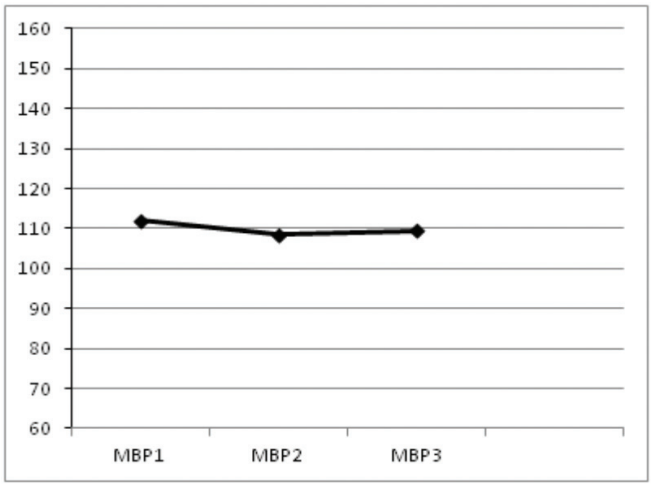
Table: *The clinical parameters of patients.*

Age		65.5±6.73
Gender (F/M)		12/15
Mean central corneal thickness (µm)		553.5±29.9
Mean best corrected visual acuity (Snellen)		0.7±0.2
Mean intraocular pressure (mmHg)	Before ICA	18.3±3.7
	During ICA	18.5±.4.2
	After ICA	18.0±3.3
		p>0.05
Mean blood pressure (mmHg)	Before ICA	112±18.7
	During ICA	108.5±13.4
	After ICA	109.4±12.2
		p>0.05
Mean ICA duration (min)		10±2

ICA; Invasive Coronary Angiography.



Graphic 1: *The mean intraocular pressure values during invasive coronary angiography.*



Graphic 2: *The mean blood pressure measurements during invasive coronary angiography.*

RESULTS

Mean age of patients was 65.5±6.7 years. Profiles of patients are shown in table. IOP1, IOP2 and IOP3 values of right eye were 18.3±3.7 mmHg, 18.5±.4.2 mmHg and 18.0±3.3 mm-Hg, respectively. The difference among IOP1, IOP2 and IOP3 was not statisticaly significant (p>0.05). MBP1, MBP2 and MBP3 values were 112±18.7 mmHg, 108.5±13.4 mmHg and 109.4±12.2 mmHg, respectively (Table, Graphic 1-2). MBP values tend to show a decreasing line during procedure; however this decrease was not statistically significant (p>0.05). There was no correlation between MBP and IOP values (all p>0.05). 11 patients had plaque without stenosis. A finding of pseudoexfoliation was present in 4 patients (14.8%).

DISCUSSION

The prevalence of primary open-angle glaucoma (POAG) increases significantly with age and persons over 80 years age have the highest prevalence of POAG among all races.[10] A multiethnic population- showed 10-fold increases in POAG prevalence between the 5th and 9th decades of life.[11] A history of heart disease is already considered to be a risk factor for the development of glaucoma.[12] Meira-Freitas et al reported an association between chronic heart failure and glaucoma. It is suggested that the presence of glaucoma in patients with heart failure may be related to low cerebral blood flow.[13] The patients who undergone ICA may be more prone to vascular endothelial and autonomic dysfunction. Abnormal blood flow and unstable perfusion were seen in the patients with autonomic and endothelial dysfunction which may coexist with glaucoma.[14-16] It has been shown that ocular perfusion pressure and systolic/diastolic blood pressure were simultaneously depressed between 7am and 12am in healthy individuals, even so IOP showed no alteration.[17] The correlation between IOP and systolic/diastolic blood pressure has been determined.[17-19]

In present study, our results showed no correlation between MBP and IOP during ICA. We believe that the absence of the significant alteration in MBP and IOP values may have led to this conclusion. Jürgens et al.,[17] showed the effect of systemic blood pressure on ocular circulation in glaucoma progression. In addition, the atherosclerotic patients, who are the candidate of ICA, can be more susceptible to IOP changes because ocular blood flow disturbances and vascular endothelial dysfunction may be more seen in these patients. But, we found no significant IOP alteration in our patients during procedure. Previous studies have displayed that pseudoexfoliation (PEX) syndrome was related to many cardiovascular diseases.[20] Greater diurnal fluctuations and marked spikes in IOP values could be seen in PEX syndrome which is currently the most important single identifiable risk factor for open-angle glaucoma. These spikes worsen the prognosis of glaucoma.[21] But, we found no significant IOP fluctuation and spike in our PEX syndrome patients during procedure. The effect of rheological factors on the POAG development was indicated.[22] Especially, plasma viscosity measurements were found higher in patients with POAG[23] Hemotologic alterations were also observed just after ICA[24] But they were exactly different as seen in POAG. It is well established that IOP has circadian variation in both healthy individuals and those with glaucoma, although IOP fluctuation is magnified in glaucomatous eyes.[25] Diurnal fluctuations up to 5 mmHg in IOP can occur among normal individuals.[26] We recorded a part of fluctuation during ICA process in order to therapeutically intervene if an increase above 5 mmHg occurs. None of the individuals reflected an increase out of predicted values. We used Tonopen XL for measurement of IOP values during the procedure in our study. It has been shown that there was no significant difference between Tonopen and Goldmann applanation tonometer in terms of IOP measurement results.[27]

The possible complication of ICA are bleeding at the point of the catheter insertion, damage to arteries, heart attack or arrhythmia, allergic reaction to x-ray dye blood clot formation. Few ophthalmic complications of ICA are reported in literature. But to our best knowledge there was no Naveed et al reported a case of transient cortical blindness after coronary angiography.[28] Several theories have been proposed to explain the pathophysiology of this situation. However, direct neurotoxic effect of the contrast agent on the blood-brain barrier in the occipital lobe is widely encountered.[29] Although newer hypoosmolar and non-ionic radiographic contrast medias developed, it still remains as a potential risk of the procedure. Cortical blindness may proceed as a permanent situation and differantial diagnosis with thromboembolism (posterior cerebral artery/top of the basilar artery syndrome), vasospasm of the posterior cerebral arteries, contrast-induced hypotension, hysterical blindness and contrast-induced cortical blindness should be considered.[30] Muqit et al.,[31] reported a case of Parinaud syndrome and oculomotor palsy due to thromboembolysm after ICA. A case of supranuclear ophthamoplegia after coronary angiography has also been reported and related with the same pathophysiologic cascade.[32] None of our patients had ophthalmic complications after ICA. Our study has some limitations. ICA is a short duration process. So, it may be diffucult to observate the IOP fluctuations in a short duration process as ICA. Parallel with this,we didn't find any meaningful results in terms of IOP alterations during ICA in our study. For the same reason, if we had measured the IOP alterations in glaucoma patients during ICA, we might have found no meaningful results, as well.

In conclusion, to our best knowledge, this is the first study investigating the change of IOP values during the ICA procedure. This study indicates that ICA is a safe procedure in terms of IOP alterations and no additional or profilactive therapy is required for sudden IOP changes.

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