PERKÜTAN KORONER GİRİŞİM SIRASINDA ŞİŞİRME BASINCINI ETKİLEYEBİLEN FAKTÖRLER

The Factors that May Affect Coronary Balloon Inflation Pressure During Percutaneous Coronary Intervention

Levent ÖZDEMİR (0000-0002-1253-5673), Erdoğan SÖKMEN (0000-0002-8170-5912)

Department of Cardiology, Kırşehir Ahi Evran University Education and Research Hospital, Kırşehir, Turkey

Levent ÖZDEMİR, Uzm. Dr.
Erdoğan SÖKMEN,Dr. Öğr. Üyesi

ÖZET

Amaç: Perkütan coroner girişim (PKG) sırasında coroner balon üzerindeki çöküntünün kaybolması beklenmektedir. Bazı hastalarda bu koroner balon çöküntüsünün kaybolması için daha yüksek basınçlara çıkılmasına gerek duyulabilir. Yüksek şişirme basınçları, koroner diseksiyon ve rupture gibi akut komplikasyonlar açısından bir risk teşkil etmektedir. Bu çalışmadaki hipotezimiz koroner balondaki çöküntünün kaybolması için uygulanması gereken şişirme basıncı ile hastaların demografik özellikleri, biyokimyasal belirteçleri ve lezyon lokalizasyonu arasında bir ilişki olup olmadığının araştırılmasıdır.

Materyal ve Metod: Bu çalışmaya kararlı anjina pectoris yakınması olan 97 hasta prospektif olarak dahil edilmiştir. Hastaların hipertansiyon, diyabet, yaş ve sigara içiciliği gibi demografik özellikleri not edilmiş olup sonrasında lipit paneli, kalsiyum, kreatinin ve hematocrit gibi biyokimyasal belirteçleri ölçülmüştür. Koroner anjiyografi yapılarak sorumlu lezyonun lokalizasyonu, kalsifikasyon derecesi belirlenmiştir. Sonrasında hastalar koroner balondaki çöküntünün kaybolması için gereken şişirme basınçlarına göre iki gruba ayrılmıştır. 8 mmHg'ye kadar şişirme basıncına gereksinim duyulan hastalar Grup 1'i; 8 mmHg'den daha yüksek şişirme basıncına gerek duyulan hastalar Grup 2 olarak tanımlanmıştır.

Bulgular: Sigara içiciliği, lezyonun damarın proksimal kesiminde yerleşim göstermesi, lezyonda kalsifikasyon varlığı gibi özellikler istatistiksel olarak anlamlı şekilde Grup 2'de daha fazla görülürken($p<0.05$), daha ileri yaş gibi özellikler de Grup 2'de daha sık gözlenmiş olup istatistiksel olarak anlamlılık seviyesine ulaşmamıştır ($p>0.05$). Diyabet varlığı, metabolik sendrom varlığı, hastanın kullanmakta olduğu ilaçlar, trigliserit düzeyi, LDL-kolesterol düzeyi, HDL-kolesterol düzeyi, kreatinin düzeyi, ürik asit ve hemoglobin düzeyleri gibi belirteçlerin PKG şişirme basınçları üzerinde etkisi olmadığı tespit edilmiştir ($p>0.05$).

Sonuç: Sigara içiciliği, sorumlu lezyonun damarın daha proksimalinde yerleşim göstermesi ve lezyonun kalsifikasyon derecesi, PKG sırasında daha yüksek şişirme basınçları gerektiren risk faktörleridir.

Anahtar Kelimeler: *Kalsifikasyon; Sigara içimi; Şişirme basıncı; Lezyon lokalizasyonu; Perkütan koroner girişim*

ABSTRACT

Background: Disappearing of indentation on coronary balloon is desired in percutaneous coronary intervention (PCI). We may need high inflation pressure to disappear indentation of coronary balloon for some patients. High inflation pressures are a risk factor for acute complications such as coronary dissection and rupture. We hypothesized, whether there are any relation between coronary balloon inflation pressure that necessitates disappearing of indentation with patient's characteristics, biochemical markers and lesion localization.

Material and Methods: 97 patients with stable angina were enrolled prospectively for this study. We noted clinical characteristics of patients such as hypertension, diabetes, age and smoking, and then measured biochemical markers as lipid profile, calcium, creatinine, hematocrits etc. As well as lesion localization and calcification degrees on culprit vessel evaluated through Coronary Angiography. The patients were divided into two groups according to their inflation pressure that necessitates disappearing of indentation on balloon through PCI. We defined inflation pressure up to 8 mmHg for group 1, whereas over 8 mmHg for group 2.

Results: Smoking, proximal lesion localization of the vessel, calcification on the culprit vessel were more frequent in group 2 ($p<0.05$), though, older age and Hypertension were frequent in group 2 without statistically importance ($P>0.05$). Diabetes, metabolic syndrome, patient's medications and level of triglyceride, LDL-cholesterol, HDL-cholesterol, creatinine, uric acid also hemoglobin didn't have any effect on inflation pressures during PCI ($p>0.05$).

Conclusion: Smoking, proximal lesion localization of the vessel, calcification degrees on the culprit vessel are risk factors for high inflation pressures through PCI.

Keywords: *Calcification; Smoking; Inflation pressure; Lesion localization; Percutaneous coronary intervention*

İletişim:
Uzm. Dr. Levent ÖZDEMİR,
Kervansaray Mahallesi, 2019. Sok. No:1, 40100, Merkez, Kırşehir.
Tel: +905323432464
e-mail:
drolevent@gmail.com

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Introduction

Since the first percutaneous transluminal coronary angioplasty performed by A. Gruentzig in 1977, percutaneous coronary interventions (PCI) have become the most important treatment modality for coronary heart disease. Coronary angioplasty involves substantial risk for coronary dissections and rupture during procedure. In addition, restenosis also may be seen mostly in first six months and later too, after PCI. Inflation pressure is important factor for complications during the PCI and also related for restenosis through post follow-up. The benefits of the optimal inflation pressure may reduce dissection, rupture and restenosis. Low inflation pressure results in under-dilatation and is associated with restenosis. However, high inflation pressure increases the risk of acute complications such as coronary dissection and perforation may result of coronary bypass surgery. Vessel injury during PCI is highly dependent on atherosclerotic plaque composition, eccentricity of treated segment, and balloon barotraumas. Atherosclerotic plaque in coronary arteries is mostly composed of fibrous tissue with variable amounts of calcific deposits (hard plaque). However, practically, atherosclerotic plaques mainly have dense collagen or calcific deposits. Hard atherosclerotic plaque is commonly noticed in patients with stable angina pectoris, and these patients may need high inflation pressure during PCI. On the other hand, high inflation pressure also may bring acute complications. Predicting the patients who need high inflation pressure before PCI might help us become aware of acute complications of procedure.

The purpose of this study to predict which patient may need high inflation pressure before performing PCI in stable angina, by taking consideration of patient's characteristics, biochemical tests and lesion localization on the vessel.

Material and Methods

97 patients with stable angina who had elective PCI were admitted for the study consecutively and prospectively. All patients had class III or IV angina and no history of recent acute coronary syndromes in last 28 days. Coronary balloon was inflated gradually with the pressure of one atmosphere. Inflation pressure is required for disappearing of indentation on coronary balloon: If inflation pressure was less than 8 atmosphere or equal then it defined as low inflation pressure group (Group A). Over 8 atmospheres was subjected to high inflation pressure group (Group B). Biochemical parameters were also analyzed in licensed laboratory. The study was approved by local ethic committee. All patients were informed about the study, and their written consents were obtained.

Statistical analysis

Continuous variables were given as mean ± SD and defined as percentage too. A value of $p < 0.05$ was considered to be statistically significant. Chi-square test was used to analyze to represent how the parameters were interlinked. SPSS 15.0 software was used for statistical analysis (Version 15, SPSS Inc., Chicago, IL, USA).

Result

A total of 97 patients, 50 were over 65 years old. Both groups (the low inflation and the high inflation) had male dominance. No significant difference was found between the groups in terms of gender, diabetes mellitus, hypertension, BMI and biochemical parameters (Table 1). Predictors for high inflation pressure were found as smoking, proximal lesion localization on the vessel and calcification on the culprit vessel ($P < 0.5$), given in Table 1. Hypertension and over 65 years; although not statistically significant; each had a risk for high inflation ($P > 0.5$) (Table 1).

On the other hand, Diabetes Mellitus, metabolic syndrome, alcohol intake, triglyceride , HDL cholesterol, serum creatinine, uric acid, hemoglobin levels , and the taking of acetyl salicylic acid, beta- blocker, statin and ACE-I were found unrelated on inflation pressures during PCI ($p > 0.05$) (Table1).

There were no significant differences between death rates (1.2% vs. 1.2%), myocardial infarction (3.0% vs. 3.2%), or CABG (2 % vs.1,8 %) group 1 and 2 respectively through in-hospital stay.

Table 1. Demographic characteristics of the study population.

	Low Inflation Group (n=50)	**High Inflation Group (n=47)**	**P value**
Age over 65 year	22	28	0,08
Female/Male (%)	48/52	34/66	0,3
Diabetes Mellitus(%)	52	52	0,9
Hypertension (%)	61	64	0,09
Smoke (%)	47	66	<0,001
BMI (kg/m2)	31,9± 4,9	30,9± 5,5	0,6
Creatinin (mg/dL)	0,8± 0,1	0,8± 0,1	0,9
Hemoglobin (mg/dL)	13± 2,0	13,5± 2,5	0,5
Total cholesterol (mg/dL)	177± 39	183± 45	0,7
Triglyceride (mg/dL)	145± 79	119± 71	0,3
LDL-C (mg/dL)	116± 30	124± 36	0,5
HDL-C (mg/dL)	35± 8	36± 7	0,7
HbA1C	5,9± 0,7	6,2±1,5	0,5
Uric acid (mg/dL)	5,6± 1,4	5,8± 1,2	0,6
Proximal localization of the vessel	30	44	<0.001
Calcification on the culprit vessel	13	22	<0,001

Discussion

Our study showed that smoking, lesion localization on the proximal vessel, calcifications on the culprit vessel are the predictors for high inflation pressure in PCI. Balloon dilatation in coronary arteries results in morphological changes. Data from animal model studies have provided consistent evidence for the mechanism of balloon injury to tissue and cellular levels (1). Inflation of balloon results in compression of plaque which may cause deep tissue dissection that can be observed through angiography and intravascular ultrasound IVUS (2).

The lower inflation pressure with residual stenosis have much lower risk of coronary dissection which is preferred over high inflation pressure without residual stenosis otherwise high risk of acute complications (3-4).

Most coronary stenoses responds to pressure with less than or equal 8 atmosphere (5). Although for some lesions, 20 atmosphere or over may be required to reach optimal expantion of the balloon (6-7). Anginal pattern, age, lesion related vessel and history of smoking are related plaque morphology (8). The Cutting Balloon is confirmed for predilating a circumferential, heavily calcified lesions (9). Coronary artery calcification may affect stent deployment, which may cause further restenosis (10).

Calcified lesions may cause for suboptimal expansion of the stent that may contribute subsequent risks of in-stent restenosis and thrombosis.

High inflation pressure may result several major complications such as coronary dissection and rupture. High inflation pressure could be predictable before PCI, it may alert to operator in terms of complications. In our study, smoking, lesion localization on the proximal part of the vessel and calcification on the culprit vessel were significantly higher in high inflation pressure group than low inflation pressure group.

Age over 65 years and hypertension were higher in high inflation pressure group than low inflation group, but the difference did not reach statistical meaning. Smoking and hypertension are the main risk factors for the formation of hard plaque in previous studies (11, 12). Our study showed high inflation pressure was needed in these groups concordant with the previous studies.

Our study also showed hypertension and smoking is a risk factor for high inflation pressure as in previous studies. In addition, lesion localization on the proximal part of the vessel, calcification on the culprit vessel and age may contribute to the formation of hard plaque and may undergo to high pressure during PCI.

Limitations of our study are relatively small number of participants and no follow-up data in patients with high inflation pressure. The studies with the high volume patients and follow-up are needed to show particular risk factors for high inflation pressure.

Conclusion

This study shows that smoking, lesion localization on the proximal vessel, calcifications on the culprit vessel are the predictor factors for high inflation pressure in PCI. Older patients with hypertension and smoking have higher risk for coronary rupture and acute complications in PCI because of the necessity of high inflation pressures.

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