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Original article

Predictors of prolonged fluoroscopy time in diagnostic coronary angiography

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ABSTRACT

Background: Prolonged fluoroscopy time during coronary angiography is a major concern for interventional cardiologists as well as for patients. It is unknown which factors affect the prolonged fluoroscopy time.

Methods: A total of 458 patients who underwent diagnostic coronary angiography were included. The patients who had the highest decile of fluoroscopy time were assigned to the prolonged fluoroscopy group (fluoroscopy time ≥15.7 min), while the other patients were assigned to the non-prolonged fluoroscopy group (fluoroscopy time <15.7 min). We performed univariate and multivariate logistic regression analysis to identify the predictors of prolonged fluoroscopy time.

Results: Mean fluoroscopy time in 458 patients was 8.5 ± 5.8 min. Median and ranges of fluoroscopy time were 19.0 [15.7–47.0] min in the prolonged fluoroscopy group and 6.0 [2.0–15.3] min in the non-prolonged fluoroscopy group, respectively. The multivariate logistic regression analysis showed that significant predictors of prolonged fluoroscopy time were prior surgery of ascending aorta replacement [odds ratios (OR) 11.46, 95% confidence intervals (CI) 1.53–85.74, $p = 0.02$] and the prevalence of moderate to severe aortic regurgitation (OR 2.83, 95% CI 1.20–6.66, $p = 0.02$).

Conclusions: The prior surgery of ascending aorta replacement and moderate to severe aortic regurgitation were significant predictors of the prolonged fluoroscopy time.

Introduction

While there has been rapid development of computed tomography (CT) coronary angiography in recent years [1], catheter coronary angiography is still the gold standard for the diagnosis of coronary artery disease [2]. Currently, most diagnostic coronary angiography can be performed via radial artery with 4 or 5 Fr catheter [3,4]. It is not difficult for interventional cardiologists to perform routine diagnostic coronary angiography. However, there are still some cases that require additional time and effort even in routine diagnostic coronary angiography for several reasons such as abnormal anatomy [5]. Prolonged fluoroscopy time is a major concern for interventional cardiologists as well as for patients in catheter laboratories [6,7]. It is unknown which patient characteristics affect the total fluoroscopy time in the current diagnostic coronary angiography. The purpose of this study was to investigate the predictors of prolonged fluoroscopy time.

Methods

We identified 3124 consecutive patients who underwent first coronary angiography in our medical center from June 2010 to January 2014. Patients who underwent percutaneous coronary intervention (PCI) ($n = 1113$) following coronary angiography (ad hoc PCI) were excluded. Furthermore, patients who underwent coronary angiography as well as other diagnostic catheterization such as right heart catheterization ($n = 361$), left ventriculography ($n = 370$), aortography ($n = 248$), graft angiography ($n = 286$), electro physiological study ($n = 57$), fractional flow reserve ($n = 50$), provocation test for vasospastic angina ($n = 29$), left ventricular end-diastolic pressure measurement ($n = 14$), subclavian arteriography ($n = 2$), femoral vein angiography ($n = 1$), and cine-angiography of mitral valve ($n = 1$) were also excluded. In addition, we excluded patients who received intra-aortic balloon

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pump (IABP) ($n = 14$), extracorporeal membrane oxygenation (ECMO) ($n = 4$), temporary pacemaker ($n = 22$), and hemodialysis catheter ($n = 2$). Additionally, patients who did not undergo echocardiography within 6 months ($n = 92$) were also excluded. Finally, a total of 458 patients who underwent only diagnostic coronary angiography were included in the analysis (Fig. 1).

Prolonged fluoroscopy time was arbitrarily defined, since there is no standard threshold for prolonged fluoroscopy time in diagnostic coronary angiography. The highest decile of fluoroscopy time (the top 10% of fluoroscopy time) in 458 patients was adopted as the threshold. Then, the patients who had the highest decile of fluoroscopy time were assigned to the prolonged fluoroscopy group, while the other patients (the other 90% of fluoroscopy time) were assigned to the non-prolonged fluoroscopy group.

Clinical criteria were defined as follows. Hypertension was defined as systolic blood pressure >140 mmHg, diastolic blood pressure >90 mmHg, or medical treatment for hypertension. Diabetes mellitus was defined as a hemoglobin A1c level >6.5% or treatment for diabetes mellitus. Dyslipidemia was defined as a total cholesterol level >220 mg/dl, a low-density lipoprotein cholesterol level >140 mg/dl or treatment for dyslipidemia. Chronic kidney disease (CKD) was defined as estimated glomerular filtration rate (eGFR) <30 ml/min before coronary angiography.

Echocardiographic findings were measured with transthoracic echocardiography by skilled sonographers. Aortic diameter was measured by M-mode echocardiography in the left parasternal long-axis view at the level of the sinuses of Valsalva in end-diastole [8]. Left atrial diameter (LAD) was also measured by M-mode echocardiography. Left ventricle diastolic diameter (LVDd) was measured by M-mode echocardiography, and ejection fraction (EF) was calculated with Teichholz method. Moderate or severe valvular heart diseases such as aortic stenosis (AS), aortic regurgitation (AR), mitral regurgitation (MR), and mitral stenosis (MS) were also investigated. Severity of valvular heart disease was determined according to American College of Cardiology/American Heart Association 2006 guidelines for the management of patients with valvular heart disease [9]. Operator's experience was assessed according to whether the primary operator had a board certification of Japanese Association of Cardiovascular Intervention and Therapeutics (CVIT). This study was approved by the institutional review board and written informed consent was waived because of the retrospective design.

Statistical analysis

All analyses were performed using the statistical software SPSS version 18 (SPSS, Inc., Chicago, IL, USA). Categorical variables were presented as numbers (percentages). First, univariate logistic regression analysis was applied to all variables to identify the predictors of prolonged fluoroscopy time. Second, multivariate logistic regression analysis was applied to all variables that had significant association in univariate analysis ($p < 0.05$) and age and sex to identify the determinants and predictors of prolonged fluoroscopy group. Odds ratios (OR) and 95% confidence intervals (CI) were calculated. In this logistic regression model, the

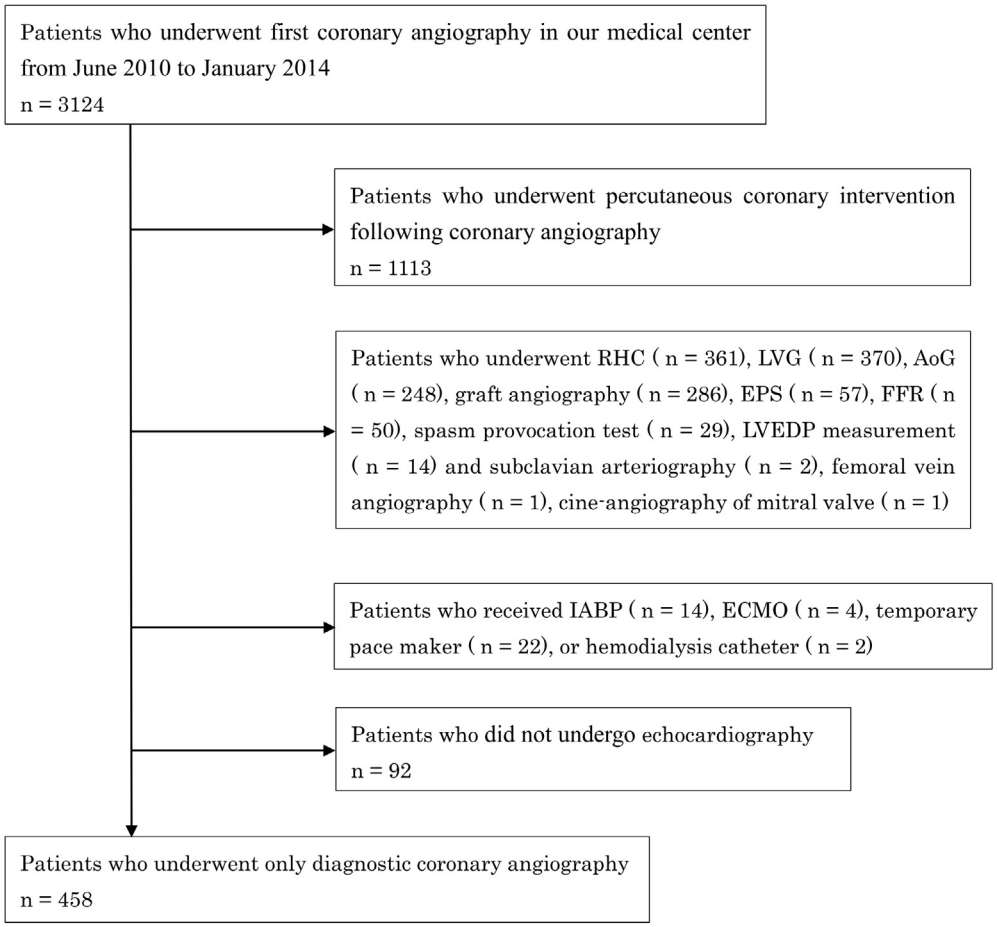

Fig. 1. Flowchart of study population. RHC, right heart catheterization; LVG, left ventriculography; AoG, aortography; EPS, electrophysiological study; FFR, fractional flow reserve; LVEDP, left ventricular end-diastolic pressure; IABP, intra-aortic balloon pumping; ECMO, extracorporeal membrane oxygenation.