

Value of three-dimensional echocardiography study of left ventricle function correlated to coronary arterial dominance in predicting the outcome of primary percutaneous coronary intervention

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Background: Limited information is available regarding the relationship between coronary vessel dominance and outcome after ST-segment elevation myocardial infarction (STEMI).

Objectives: The study was designed to evaluate the prognostic value of coronary arterial dominance after primary percutaneous coronary intervention (PCI) during hospital stay and at 3 months follow-up regarding cardiac mortality, heart failure, nonfatal myocardial infarction, revascularization, and stroke.

Patients and methods: The study population consisted of 300 consecutive patients (mean age, 57.35 ± 13.41 years; 91% men) with STEMI who were admitted to Dallah Hospital (Riyadh, Saudi Arabia) from January 2015 to December 2016. These patients underwent successful primary PCI with thrombolysis in myocardial infarction (TIMI) III flow. They were divided into three groups according to angiographic coronary dominance: 227 (75.7%) in the right coronary dominant group, 40 (13.3%) in the left coronary dominant group, and 33 (11%) in the balanced coronary dominant group. They were evaluated with two- (2D) and three-dimensional (3D) echocardiography within 48 hours of admission and at 3 months follow-up after STEMI.

Results: Right dominance was present in 75.6%, left dominance in 13.3%, and balanced dominance was present in 11% of patients. The main finding of this study was that a left dominant system was associated with increased risk of cardiac mortality, heart failure, nonfatal myocardial infarction, revascularization, and stroke shortly after primary PCI, during hospital stay, and at 3 months follow-up after STEMI. Moreover, a significantly lower left ventricular ejection fraction at admission was observed by both 2D and 3D echocardiography in patients with a left dominant system.

Conclusion: In patients with STEMI treated with primary PCI, left coronary artery dominance confers a higher risk of various adverse clinical events after primary PCI, during hospital stay, and at 3 months follow-up compared to right and balanced coronary artery dominance.

Disclosure: Authors have nothing to disclose with regard to commercial support.

Received 16 August 2017; revised 1 January 2018; accepted 3 January 2018.

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Peer review under responsibility of King Saud University.

URL: www.ksu.edu.sa

<https://doi.org/10.1016/j.jsha.2018.01.001>



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Please cite this article in press as: Hanboly N.H. et al., Value of three-dimensional echocardiography study of left ventricle function correlated to coronary arterial dominance in predicting the outcome of primary percutaneous coronary intervention, J Saudi Heart Assoc (2018), <https://doi.org/10.1016/j.jsha.2018.01.001>

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Keywords: Coronary arterial dominance, Primary percutaneous coronary intervention, Three dimensional echocardiography

Introduction

The coronary artery that supplies the posterior descending artery (PDA) and posterolateral branches is defined as coronary vessel dominance that affects the relative clause of the different coronary arteries to the total left ventricular blood flow [1]. The right coronary artery (RCA) supplies the posterior portion of the interventricular septum and gives the PDA in a right-dominant circulation. By contrast, when the left circumflex (LCX) artery supplies this territory, it is called left-dominant circulation [1]. In a codominant circulation, the supply of the posterior interventricular septum is shared by the RCA and the LCX [2,3]. Right-dominant circulation is a well-balanced coronary circulation in which the left ventricle (LV) is supported by all coronary blood flow through three arteries; this is in contrast to patients with a left dominant system, where 60% of the LV myocardium is supplied by the PDA and the posterolateral branches originating from the LCX [4]. This less well-balanced coronary circulation might have an undue influence on the prognosis of patients with coronary artery disease (CAD). Up to now, the prognostic importance of coronary vessel dominance in patients presenting with first ST-segment elevation myocardial infarction (STEMI) remains uncertain [4]. There is limited knowledge about the clinical relevance of this anatomical variation, but the presence of a left dominant system was associated with an increased mortality in patients presenting with acute coronary syndrome (ACS) that was observed by Goldberg et al. [5] and the National Cardiovascular Database Cath Percutaneous Coronary Intervention (Cath-PCI registry) [6] as both showed higher in-hospital mortality after percutaneous coronary intervention (PCI) in patients with a left dominant system [6]. Short- and long-term outcomes of patients with STEMI who undergo primary PCI have been affected by left ventricular systolic dysfunction and remodeling [7]. Infarct size, heart rate, and severity of coronary artery disease were independent predictors of LV systolic dysfunction and remodeling after STEMI [8–10]. LV dysfunction is also affected by coronary arterial dominance, as Yip et al. [11] showed that a

Abbreviations

PDA	Posterior descending artery
RCA	Right coronary artery
LCX	Left circumflex artery
LV	Left ventricle
ACS	Acute coronary syndrome
STEMI	Segment elevation myocardial infarction
TIMI III flow	Thrombolysis In Myocardial Infarction III flow
PCI	Percutaneous coronary intervention
BCD	Balanced coronary dominant group
LCD	Left coronary dominant group
LVEF	Left ventricle ejection fraction
2D	Two Dimensional echocardiography
3D	Three Dimensional echocardiography
EDV	End diastolic volume
ESV	End systolic volume
LD	Left dominant anatomy
REBUS study	RElevance of Biomarkers for future risk of thromboembolic events in UnSelected post-myocardial infarction patients
WMSI	Wall motion score index
MAPSE	Mean annular plane systolic excursion
PREDICTION study	Prediction of Progression of Coronary Artery Disease and Clinical Outcomes Using Vascular Profiling of Endothelial Shear Stress and Arterial Wall Morphology

left dominant system was independently predictive of failed reperfusion in patients with LCX artery infarction. The effect of coronary arterial dominance on LV dysfunction and remodeling at follow-up is unclear [12].

Three-dimensional (3D) echocardiography is a novel imaging technique based on acquisition and display of volumetric data sets in the beating heart. This permits a comprehensive evaluation of LV anatomy and function from a single acquisition. Moreover, it allows assessment of the geometry and function of LV without pre-established assumptions regarding cardiac chamber shape and allows an echocardiographic assessment of the LV that is less operator-dependent and therefore more reproducible [13].

The aim of this study was to evaluate the prognostic value of coronary arterial dominance after primary PCI on cardiac mortality, heart failure, nonfatal myocardial infarction, revascularization, stroke, and readmission for ACS and LV systolic function studied using the novel 3D echocardiography.

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