

Original article

Prognostic Impact of Chronic Total Occlusion in a Nonculprit Artery in Patients With Acute Myocardial Infarction Undergoing Primary Angioplasty



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Article history:

Received 8 July 2013

Accepted 2 August 2013

Available online 13 February 2014

Keywords:

Myocardial infarction

Prognosis

Chronic total occlusion

Primary angioplasty

ABSTRACT

Introduction and objectives: The prognostic value of chronic total occlusion in nonculprit coronary arteries in patients with myocardial infarction undergoing primary angioplasty remains controversial. Several publications have described different methodologies and conflicting findings. In addition, causes of death were not reported. Our aim is to analyze the prognostic impact of chronic total occlusion in nonculprit coronary arteries and the role of left ventricular ejection fraction in this analysis.

Methods: Prospective inclusion of consecutive patients with ST-segment elevation myocardial infarction who underwent primary angioplasty. We recorded baseline characteristics, in-hospital clinical course, and mortality and its causes during follow-up. We assessed the impact of chronic total occlusion on mortality using Cox regression analysis.

Results: Chronic total occlusion in nonculprit arteries was present in 125 of 1176 patients (10.6%); in 79 of these 125 patients, chronic total occlusion was present in the proximal segments. The mean follow-up was 339 days; 64 (5.8%) patients died during the first 6 months. Patients with chronic total occlusions had more comorbidities, poorer ventricular function, and higher mortality (hazard ratio=2.79; 95% confidence interval, 1.71-4.56). Chronic total occlusion was also associated with noncardiac death (hazard ratio=3.83; 95% confidence interval, 2.10-7.01). Chronic total occlusion in proximal segments was associated with both cardiac (hazard ratio=3.22; 95% confidence interval, 1.42-7.30) and noncardiac deaths (hazard ratio=3.43; 95% confidence interval, 1.67-7.06). The multivariate analysis performed without including left ventricular ejection fraction showed a significant association between chronic total occlusion and mortality. However, when left ventricular ejection fraction was included in the analysis, this association was nonsignificant (hazard ratio=1.76; 95% confidence interval, 0.85-3.65; $P=0.166$).

Conclusions: Chronic total occlusion in this clinical setting identified patients at higher risk with more comorbidities and higher mortality, but did not behave as an independent predictor of mortality when left ventricular ejection fraction was included in the analysis.

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Valor pronóstico de la oclusión total crónica de una arteria no responsable en el infarto agudo de miocardio tratado con angioplastia primaria

RESUMEN

Introducción y objetivos: El valor pronóstico de una oclusión total crónica en arterias no responsables en el infarto de miocardio tratado mediante angioplastia primaria es controvertido. Los artículos publicados presentan importantes diferencias metodológicas y resultados opuestos, sin describir causas de mortalidad. Nuestro objetivo es analizar el impacto pronóstico de la oclusión total crónica de arteria no responsable en la mortalidad y el papel de la fracción de eyección del ventrículo izquierdo en dicho análisis.

Métodos: Inclusión prospectiva de pacientes consecutivos con infarto agudo de miocardio con elevación persistente del segmento ST sometidos a angioplastia primaria, con registro de características basales, complicaciones, mortalidad y sus causas durante el seguimiento. Se evaluó el impacto de la oclusión total crónica en la mortalidad mediante el análisis de regresión de Cox.

Resultados: Presentaban oclusión total crónica de arteria no responsable 125 (10,6%) de 1.176 pacientes (79 de 125 en segmentos principales). El seguimiento medio fue de 339 días; 64 pacientes (5,8%)

Palabras clave:

Infarto de miocardio

Pronóstico

Oclusión total crónica

Angioplastia primaria

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fallecieron en los primeros 6 meses. Los pacientes con oclusión total crónica presentaban más comorbilidades, peor función ventricular y mayor mortalidad total (*hazard ratio* = 2,79; intervalo de confianza del 95%, 1,71–4,56) y extracardiaca (*hazard ratio* = 3,83; intervalo de confianza del 95%, 2,10–7,01). La oclusión total crónica en segmentos principales se asoció con muerte cardiaca (*hazard ratio* = 3,22; intervalo de confianza del 95%, 1,42–7,30) y extracardiaca (*hazard ratio* = 3,43, intervalo de confianza del 95%, 1,67–7,06). El análisis multivariable sin la fracción de eyección del ventrículo izquierdo mostró asociación significativa entre oclusión total crónica y mortalidad, aunque tras incluir la fracción de eyección del ventrículo izquierdo en los análisis, dicha asociación resultó no significativa (*hazard ratio* = 1,76; intervalo de confianza del 95%, 0,85–3,65; $p = 0,166$).

Conclusiones: La oclusión total crónica en este escenario resulta marcador de riesgo, comorbilidades y mayor mortalidad, aunque no se comporta como predictor independiente de mortalidad tras incluir la fracción de eyección del ventrículo izquierdo en el análisis.

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Abbreviations

CTONr: chronic total occlusion in nonculprit artery
 HR: hazard ratio
 LVEF: left ventricular ejection fraction
 PA: primary angioplasty

INTRODUCTION

Primary angioplasty (PA) is currently the treatment of choice for acute myocardial infarction with persistent ST-segment elevation.¹ In this clinical setting, the presence of multivessel disease is associated with poorer prognosis.^{2–4} However, the prognostic value of the presence of chronic total occlusion in nonculprit artery (CTONr) in these patients is much more controversial.^{4–10} Although several previous articles have described a prognostic impact of CTONr on mortality, more recent data have not confirmed this impact,⁴ the main methodological difference being the inclusion of variables such as left ventricular ejection fraction (LVEF) or creatinine clearance in the analyses. In addition, there is no information on the causes of death in this setting.

The purpose of our study was: *a*) to analyze the impact of CTONr on patients' total mortality 6 months post-PA in our setting and to elucidate the possible role of variables such as LVEF and Killip class in this association; *b*) to analyze the causes of mortality based on the presence of CTONr, and *c*) to analyze the impact of the type of CTONr vessel on mortality and its causes.

METHODS

Study Population and Health Care Protocol

All patients with ST-segment elevation acute myocardial infarction referred to our hospital for PA in the first 12 h postinfarction between October 2009 and June 2012 were prospectively included in the series. The reperfusion protocol is activated as part of the "Infarct Code" program implemented in the autonomous community of Catalonia in 2009. The criteria used to activate the protocol were the presence of chest pain with onset less than 12 h previously with ST-segment elevation of 1 mm or greater in 2 contiguous leads or newly acquired left bundle-branch block.

The therapeutic protocol included the administration at diagnosis of an oral dose of 250–300 mg of acetylsalicylic acid, an oral loading dose of 600 mg of clopidogrel, and parenteral anticoagulant, preferably with unfractionated heparin. Patients were immediately transferred to the referral interventional cardiology laboratory for emergent coronary angiography.

Adjuvant antithrombotic therapy (bivalirudin, glycoprotein IIb/IIIa inhibitors) was administered at the operator's discretion. The percutaneous intervention techniques, choice of stent type, and drug therapy during and after catheterization were at the operator's discretion and in accordance with current recommendations.^{11,12}

Nonculprit coronary lesions were revascularized during the initial angiography only in patients with frank hemodynamic or electric instability. Nonculprit coronary lesions were revascularized during hospitalization or follow-up at the discretion of the medical team in charge, based on the patient's clinical progress, ventricular function, degree of inducible ischemia, and angiographic features of documented lesions.

Definitions and Data Collection

Trained cardiologists collected the data prospectively, using a standard form. The data recorded consisted of baseline characteristics, medical history, biochemical and electrocardiographic findings, echocardiographic and angiographic parameters, procedures performed, in-hospital treatments, complications, and in-hospital mortality.

The hemodynamic parameters (heart rate, systolic blood pressure) and Killip class were recorded when the patient was admitted to the coronary unit. Creatinine clearance was calculated by the Cockcroft-Gault formula.¹³

LVEF was analyzed as of day 3 postinfarction by transthoracic echocardiogram using the Simpson method.

Coronary disease was quantitated by taking into account the number of epicardial arterial territories (anterior interventricular, circumflex, right coronary) with artery lumen stenosis of 70% or greater, or 50% in the case of the left common trunk. The degree of stenosis was quantitated by visual analysis. Chronic total occlusion was considered to be total (100%) occlusion of the artery lumen without anterograde flow or with flow (anterograde or retrograde) through collateral vessels in an artery other than the culprit artery.⁵ The differentiation between CTONr and acute occlusion was likewise based on the morphologic analysis (absence of fresh thrombus, presence of well-developed collateral circulation or microchannels) by the interventional cardiologist who performed the procedure.¹⁴ CTONr in a proximal artery was considered to be present in the case of segments 1–3 (right coronary), 6–7 (anterior interventricular), and 11–12 (circumflex) according to the CASS classification.¹⁵

Primary and Secondary Endpoints

The primary endpoint of the study was total 6-month mortality (including in-hospital mortality). As secondary endpoints, we recorded 6-month cardiac and noncardiac mortality.

Vital status information was collected by an analysis of hospital records and by telephone contact with the patients' relatives or

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