

Original Article

Primary or rescue percutaneous coronary intervention in smokers

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ABSTRACT

Background: Despite the close association between smoking and atherosclerotic disease development, little is known about the clinical characteristics and outcomes related to percutaneous coronary intervention (PCI) in smokers with acute coronary syndrome in Brazil. This study aimed to analyze the clinical, angiographic, and procedural profile, in addition to in-hospital outcomes, in smokers and non-smokers with acute myocardial infarction with ST-segment elevation (STEMI) submitted to primary or rescue PCI.

Methods: Cross-sectional study of the *Central Nacional de Intervenções Cardiovasculares* (CENIC) registry between 2006 and 2016. The study population included patients aged ≥ 18 years who presented with STEMI and were submitted to primary or rescue PCI.

Results: A total of 20,319 patients were included, of whom 6,880 (34.4%) were smokers. The group of smokers was significantly younger, male, and with a lower prevalence of comorbidities. At angiography, smokers showed greater complexity, with a higher prevalence of thrombi, long lesions or TIMI flow 0/1. During the procedure, smokers received a lower proportion of drug-eluting stents and thrombus aspiration was more frequent, as well as procedural success (94.2% vs. 92.1%; $p < 0.0001$). In the univariate analysis, smokers showed lower mortality (2.9% vs. 4.5%; $p < 0.0001$) and fewer major adverse cardiac events (3.3% vs. 4.8%; $p < 0.0001$). However, after multivariate analysis, smoking was not associated with a lower risk of mortality.

Conclusions: Although the clinical outcomes associated with the PCI were favorable to smokers, the multivariate analysis did not show a protective effect of smoking. Such results are due to differences in clinical and angiographic characteristics between smokers and non-smokers.

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Intervenção coronária percutânea primária ou de resgate em tabagistas

RESUMO

Palavras-chave:

Tabagismo

Angioplastia

Infarto agudo do miocárdio

Intervenção coronária percutânea

Introdução: Apesar da estreita relação do tabagismo com o desenvolvimento da doença aterosclerótica, pouco se sabe sobre as características clínicas e os desfechos relacionados à intervenção coronária percutânea (ICP) em tabagistas com síndrome coronariana aguda no Brasil. O objetivo deste estudo foi analisar o perfil clínico, angiográfico e do procedimento, além de desfechos hospitalares, em pacientes tabagistas e não tabagistas com infarto agudo do miocárdio com supradesnívelamento do segmento ST (IAMCST) submetidos à ICP primária ou de resgate.

Métodos: Estudo transversal do registro da Central Nacional de Intervenções Cardiovasculares (CENIC) entre 2006 e 2016. A população do estudo incluiu pacientes com idade ≥ 18 anos que apresentassem IAMCST submetidos à ICP primária ou de resgate.

Resultados: Foram incluídos 20.319 pacientes, dos quais 6.880 (34,4%) eram tabagistas. O grupo de pacientes tabagistas era significativamente mais jovem, do sexo masculino e com menor prevalência de comorbidades. À angiografia, os tabagistas apresentaram maior complexidade, com maior prevalência de trombos, de lesões longas ou fluxo TIMI 0/1. Durante o procedimento, os tabagistas receberam stent farmacológico em menor proporção e a tromboaspiração foi mais frequente, bem como o sucesso do procedimento (94,2% vs. 92,1%; $p < 0,0001$). Na análise univariada, pacientes tabagistas apresentaram

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menor mortalidade (2,9% vs. 4,5%; $p < 0,0001$) e menos eventos cardíacos adversos maiores (3,3% vs. 4,8%; $p < 0,0001$). No entanto, após análise multivariada, o tabagismo não se associou a menor risco de mortalidade. **Conclusões:** Embora os desfechos clínicos associados à ICP tenham sido favoráveis aos pacientes tabagistas, a análise multivariada não demonstrou efeito protetor do tabagismo. Tais resultados são devidos às diferenças encontradas nas características clínicas e angiográficas entre pacientes tabagistas e não tabagistas.

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Introduction

Cardiovascular diseases remain the leading cause of death,¹ and smoking is considered the main modifiable risk factor for these diseases, accounting for one in every three deaths.² Tobacco smoking is associated with an increased risk of death and other unfavorable outcomes in patients with acute coronary syndrome (ACS),³ in addition to changes in the lipid profile, generation of reactive oxygen species, platelet activation, and endothelial dysfunction, favoring the atherogenic process. Moreover, the risk is multiplied by four when smoking is associated with other factors, such as dyslipidemia or arterial hypertension.⁴

Smoking leads to endothelial damage and cell dysfunction. Its effects on the circulation significantly alter the endothelium hemostatic balance, resulting in atherosclerosis and its thrombotic complications. Furthermore, the components of the cigarette smoke reduce the blood's ability to carry oxygen and increase the physiological demands of the myocardium.² The cardiovascular risk attributable to smoking increases with the number of smoked cigarettes and duration of smoking; nonetheless, even exposure to low levels of cigarette smoke or secondhand smoke can be harmful.

However, the habit of smoking has been associated in some studies with a protective effect, in which smokers submitted to percutaneous coronary intervention (PCI) showed lower mortality rates in the short term – the so-called smoking paradox. Many studies on the subject have been conducted over the years, and there is now solid scientific evidence showing there is no protective effect of smoking in these patients.^{5,6} Despite the close association between smoking and the development of atherosclerotic disease, little is known about the clinical profile and outcomes related to PCI in smokers with acute myocardial infarction (AMI) in the Brazilian population. Thus, this study aimed to analyze the clinical, angiographic, and procedural profile, in addition to in-hospital outcomes, in smokers and non-smokers with ST-elevation myocardial infarction (STEMI) who underwent primary or rescue PCI in Brazil.

Methods

Study design and sample

A cross-sectional study was performed in the *Central Nacional de Intervenções Cardiovasculares* (CENIC portuguese for National Center for Cardiovascular Interventions) registry of *Sociedade Brasileira de Hemodinâmica e Cardiologia Intervencionista* (SBHCI portuguese for Brazilian Society of Hemodynamics and Interventional Cardiology) between 2006 and 2016. Data from the database were prospectively collected using standardized forms and stored in a computerized registry. Data from patients with a diagnosis of STEMI submitted to PCI from the CENIC registry were retrospectively analyzed. The

study population included patients aged ≥ 18 years who presented with STEMI and were submitted to primary or rescue PCI.

Patient diagnosis and management were carried out according to the specific routines of each collaborating center linked to the SBHCI.

Statistical analysis

The chi-squared test and the analysis of variance (ANOVA) were used for the comparison of categorical and continuous variables, respectively. When necessary, Fisher's exact test or the likelihood ratio test was used. Fisher's exact test (2×2 table) or the likelihood ratio test ($m \times n$ table, where m and/or n is greater than two categories) was carried out when at least 20% of the expected values were < 5 . To verify the influence of the variables of interest in relation to mortality, a simple logistic regression model was used to evaluate death in relation to different independent variables. Additionally, multiple logistic regression was performed using the forward selection method to determine the independent variables that best explain the occurrence of death. Variables with large occurrences of missing data were disregarded in the multiple logistic regression analysis (left ventricular dysfunction and collateral circulation). A p -value < 0.05 was considered statistical significant.

Results

At the cut-off date, the registry included 176,780 patients and a total of 191,727 procedures; 20,013 patients were selected and analyzed, resulting in 20,310 procedures, with 23,951 treated vessels.

The mean age of the cohort was 61.4 ± 12.4 years, and 20.1% of the patients had diabetes. Patients who were smokers were approximately 5 years younger than non-smokers, with a higher proportion of males, and a lower prevalence of risk factors or history of a previous coronary artery event. The other demographic and clinical characteristics of smokers and non-smokers are shown in Table 1.

Most patients had one-vessel disease (47.9%), and the most frequently treated vessel was the left anterior descending artery (47%). Thrombotic lesions (61.2% vs. 52.6%; $p < 0.0001$), long lesions (32.6% vs. 30.1%, $p = 0.0001$), and bifurcation lesions (25.9% vs. 24.7%; $p = 0.04$) were more frequently found in smokers. Collateral circulation was observed more frequently in smokers (16.7% vs. 14.1%; $p = 0.0004$), as well as Thrombolysis in Myocardial Infarction (TIMI) flow 0/1 (71.1% vs. 66.7%, $p < 0.0001$). The other angiographic features are described in Table 2. The mean number of treated vessels and stents per patient was 1.2 ± 0.5 and 1.3 ± 0.5 , respectively, in the entire cohort. Primary PCI was performed in 92.5% vs. 93.8% and rescue PCI in 7.5% vs. 6.2% of smokers and non-smokers, respectively ($p = 0.0003$). During the procedure, the group of smokers received drug-eluting stents at a lower proportion (3.9% vs.

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