New Horizons for Approach of ST-Segment Elevation Myocardial Infarction

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Abstract

In the past decades, there was a reduction in mortality from ST segment elevation acute myocardial infarction (STEMI) associated with a set of actions combining technological advances and public policies. However, its characteristic of a time-dependent disease is still responsible for a high number of cases of sudden death and the consequences of late or inefficient reperfusion are related to heart failure and increased morbidity and mortality. From this point of view, three different aspects were reviewed: the impact of ventricular arrhythmias in prehospital care; the influence of Von Willebrand factor and the role of microparticles in the diagnosis of the disease.

Keywords: Myocardial Infarction; Ventricular fibrillation; Acute coronary syndrome; Von Willebrand Factor; Cell-derived microparticles

Introduction

According to the World Health Organization, more than seven million people die every year from acute myocardial infarction (AMI), corresponding to 12.8% of all deaths. However, this rate has reduced in recent years due to the greater effectiveness of percutaneous coronary reperfusion strategies, evolution of antithrombotic therapies, development of international public policies and consolidation of secondary prevention.

Among the factors that influence the prognosis of ST segment elevation acute myocardial infarction (STEMI), some are closely related to the time-dependent aspect of this disease. In this sense, early therapy and efficacy of coronary reperfusion methods have remained the focus of contemporary lines of research.

A modern view on this disease is presented in the first volume of 2015 of the European Heart Journal Acute Cardiovascular Care, which features three relevant points, described below.

Impact of pre-hospital care

The article Impact of out-of-hospital cardiac arrest due to ventricular fibrillation in patients with ST-elevation myocardial infarction admitted for primary percutaneous coronary intervention: impact of ventricular fibrillation in STEMI patients developed by the Dutch group coordinated by Dr. Saman Rasoul, evaluated 4643 patients with STEMI in a prospective registry for five years, with the occurrence of ventricular fibrillation or ventricular tachycardia (VF or VT) before hospital admission in 7.0% (326 patients). In the study, the patients with prehospital VF/VT had higher incidence...
of occlusions of the anterior descending artery (ADA) (49.2%) and the left main coronary artery (2.3%), and higher rates of bleeding complications (1.2%). One-year mortality was 17.2% in the group with VF/VT vs. 7.0% in the group without arrhythmia. In-hospital mortality was also higher in the group with VF/VT (13.8% vs. 3.4%).

Various aspects such as: door-to-balloon time, percutaneous or surgical coronary artery bypass grafting, degree of myocardial blush and flow — TIMI — after percutaneous coronary intervention (PCI) were similar in the groups with and without prehospital cardiopulmonary arrest (CPA). Some limitations of this study were loss of patients with CRP who did not reach the hospital and no data on the duration of CPA. The tables appearing in the article present some variables little studied in other series in the context of STEMI, especially for the lower incidence of pre-hospital CPA in patients with diabetes and in the elderly. However, the most important aspect was the one-year mortality rate in patients who survived CPA and were discharged, similar in both groups (3.9% vs. 3.8%) and represents an incentive for increasing efforts to increase the effectiveness of resuscitation maneuvers and integrated response to CPA.

### Von Willebrand factor and STEMI

In another article, “Plasma levels of active Von Willebrand factor are increased in patients with first ST-segment elevation myocardial infarction: a multicenter and multiethnic study”\(^9\), who studied 1026 patients with first event of STEMI stratified by different ethnic groups (China, Italy and Scotland) and a control group, there was measurement of the von Willebrand factor (VWF) — a multimeric protein present in the plasma, platelets and endothelium with a key role in hemostasis by mediating platelet adhesion and thrombus formation secondary to endothelial lesion\(^9\).

The VWF levels collected in arterial blood in the first six hours of hospital admission were higher in the group with AMI, suggesting that this increase represents an additional risk in STEMI, highlighting the potential for study of drugs that act directly on this element of coagulation cascade.

### Microparticles and STEMI

Finally, the Parisian study Microparticles and sudden cardiac death due to coronary occlusion. The TIDE (Thrombus and Inflammation in Sudden Death) Study\(^8\) led by Dr. Jean-Philippe Empana from Sorbonne tested the hypothesis that higher concentrations of microparticles in the coronary circulation during STEMI represent a different mechanism of occlusion associated with higher incidence of ventricular arrhythmias and sudden death\(^8\).

The measurement of endothelial (CD144+), platelet (CD41+), leukocyte (CD11a+) and erythrocyte (CD235a+) microparticles was performed on blood samples taken from the aortic arch and from the artery related to PCI of 119 patients. These were separated into three groups: Elective PCI; primary PCI — during a STEMI; and PCI held after resuscitation maneuvers for sudden death event. Another interesting aspect of the methodology was the post-CPA sedation protocol, which excluded the use of the anesthetic propofol because of its composition that interferes with the dosage of microparticles in the blood.

The intracoronary concentrations of endothelial-derived microparticles was significantly higher in patients with sudden death than in those with STEMI who did not have ventricular arrhythmias, suggesting the possibility of different aspects of coronary occlusion involved in the pathophysiology of sudden death by VF/VT. This hypothesis is also being evaluated by other authors who seek to identify a potential correlation between high concentrations of microparticles and the future occurrence of ventricular arrhythmias. These preliminary data, as well as the possible prognostic role of the microparticles, require standardization, more expressive samples and validation studies to establish their actual impact on clinical practice.

### Conclusion

The Department of Coronary Artery Disease from the Society of Cardiology of Rio de Janeiro is attentive to new initiatives, notably in the STEMI setting, a time-dependent disease that is the world’s leading cause of sudden death from ventricular arrhythmia in adults.

Avant-garde studies involving potential new biomarkers such as endothelial microparticles and VWF in combination with the real world of CPA related to STEMI appearing in the Dutch record symbolize the heterogeneity of research lines on the European continent and represent...
encouragement and inspiration for the development of research in Brazil.

Potential Conflicts of Interest
This study has no relevant conflicts of interest.

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References


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This study is not associated with any graduate programs.

Point of View
The opinions expressed in this manuscript are solely those of the authors. The International Journal of Cardiovascular Sciences welcomes different points of view in order to stimulate discussions to improve the diagnosis and treatment of patients.