

Role of a STEMI network in increasing the rate of primary PCI and reducing mortality in acute myocardial infarction

Introduction

The aim of this study was to investigate the evolution of ST-Elevation Myocardial Infarction (STEMI) treatment and mortality between 2004-2011 in an unselected population from central Romania and to demonstrate the role of a regional STEMI network in increasing the rates of reperfusion therapy with associated reduction of STEMI-related mortality in this region.

Methods: We analyzed the data of 5.899 consecutive STEMI patients enrolled in this prospective study since 2004, after initiation of a STEMI network in Central Romania.

The primary end-point of the study was the in-hospital mortality rate of the included patients with STEMI.

The secondary end-points were the following:

- mortality rates in STEMI patients presenting first to a territorial hospital versus those presenting directly to a pPCI centre, in the global population and in those presenting <12 hours after onset of symptoms

- mortality rates in patients arriving more than 12 h after onset of symptoms.

- rate of reperfusion therapy (pPCI or thrombolysis) in STEMI patients presenting <12 h from symptom onset

- rate of referral for pPCI from the territorial hospitals in STEMI patients presenting <12 h from symptom onset

Results

A total number of 5.888 STEMI cases were enrolled in the registry between 1 january 2004 and 31 december 2011.

Multivariate logistic regression analysis for predictors of not receiving reperfusion therapy in a population with STEMI showed that besides presentation outside the recommended 12h timeframe, presentation to a territorial hospital instead of a pPCI centre [odds ratio (OR): 3.9, 95% confidence interval (CI): 3.2-4.78, $p<0.001$] and female gender (OR 1.6, 95% CI: 1.4-1.8, $p<0.001$) were the strongest predictors for not receiving appropriate reperfusion therapy.

In-hospital mortality rates

a) Total registry in-hospital mortality

Global in-hospital mortality for the entire period of the study was 18.08%. Mortality was significantly higher (24.62%) for cases where no reperfusion treatment was initiated. Mortality associated with thrombolysis was 14.77%, and mortality for primary PCI cases was 4.82%.

In-hospital mortality rates associated with each type of treatment for patients who presented <12 h from the onset of symptoms (thrombolysis, pPCI or no reperfusion treatment) did not present a significant change from 2004 to 2011 (16.13% in 2004 vs 12.73% in 2011 for thrombolysis, $p=0.7$; 4.76% vs 2004 to 4.49% in 2011 for pPCI, $p=1.0$; and 24.29% in 2004 vs 20.31% in 2011 for no reperfusion, $p=0.5$).

Global registry in-hospital mortality (presentations <12 h and late presentations, PCI centre and territorial centres) showed a significant and continuous decrease from 23.18% in 2004 to 13.39% in 2011 ($p<0.001$). Additionally, in-hospital mortality for patients presenting <12 h from the onset of symptoms followed a similar trend, decreasing from 20.73% in 2004 to 6.35% in 2011 ($p<0.001$).

b) In-hospital mortality for STEMI patients presenting first to a territorial hospital versus those presenting directly to a pPCI centre

For the STEMI patients presented in a territorial hospital (early plus late arrivals), the in-hospital mortality rate showed a continuous decrease, from 24.49% in 2004 to 13.73% in 2011 ($p<0.001$). For the first years of the study, the risk of death was approximately the same for the STEMI patients presenting to the territorial hospitals regardless of the time of presentation (<12 h or after), which was mainly due to a very low number of reperfusion therapy options in this era. Since 2009, a clear difference in mortality was achieved at the territory hospitals if the patient presented in the first 12 hours after the onset of symptoms.

Nevertheless, there was still a statistically significant difference in the in-hospital mortality rate in 2011 for patients who presented to the territorial hospitals versus the in-hospital mortality rate of patients who lived in a major city and presented directly to a pPCI centre (13.73% vs. 6.10%, $p<0.001$).

For patients who presented in the first 12 hours after the onset of symptoms, the difference in the in-hospital mortality rate between STEMI patients living in a major city and presenting to a pPCI centre versus those living in the surrounding areas and presenting to a territorial hospital became less apparent in 2009, after 5 years of logistic organisation in the network. The difference in mortality between the two groups was not anymore statistically significant in 2010 (8.84% vs. 5.57% in 2010, $p=0.1$; 6.81% vs. 5.33% in 2011, $p=0.3$).

c) In-hospital mortality for patients arriving more than 12 h after onset of symptoms

For cases presenting later than 12 h after the onset of symptoms, mortality remained high (25.91% in 2004 and 24.11% in 2011 ($p=0.6$)). For cases arriving in the PCI centre mortality was significantly lower and continued to decrease from 15.63% in 2004 to 7.47% in 2011 ($p=0.1$). Altogether, the total registry in-hospital mortality for late presenters decreased from 25.1% in 2004 to 20.37% in 2011 ($p=0.2$).

Rate of reperfusion therapy in STEMI patients presenting < 12 h from symptoms onset.

Introduction of a STEMI network was associated with an absolute change in the use of reperfusion therapy from 2004 to 2011 (26.94% vs 87.15%, $p<0.001$) and of pPCI (10.88/% vs 78.64%, $p<0.001$) for patients who presented within 12h after onset of symptoms, in the global network of the registry.

The logistic measures, together with the intensive educational activities, shifted the treatment strategy in STEMI patients presenting <12 h after onset of symptoms from "predominantly no reperfusion" in 2004 to "predominantly reperfusion" in 2008 (reperfusion rate 26.94% in 2004 vs. 59.89% in 2008, $p<0.001$).

Rate of referral for pPCI from the territorial hospitals in STEMI patients presenting <12 h from symptom onset.

In the first period of the study, the increase in reperfusion rates in the territorial hospitals was mainly due to an increase in the number of patients who received thrombolysis. However, the logistic measures in the network, intensive educational activities and the increased use of STEMI guidelines shifted the use of reperfusion therapy from thrombolysis to primary PCI in 2009 (pPCI vs. thrombolysis: 3.13% vs. 96.88% in 2004 to 62.64% vs. 37.36% in 2009, $p<0.001$) (fig. 3c).

Conclusions

This study shows that in a representative territory of 1 million people from Romania, reduction of STEMI related mortality was possible via implementation of primary PCI even in the country with the lowest budget dedicated to healthcare from Europe.

Our study shows that it took at least 5 years of intensive work to implement a new therapeutic strategy in a community. The major progress of the primary PCI rates in our

experience was recorded after 5 years of work in the community, when the most significant mortality decrease and increase in pPCI rate have been achieved.

Keywords: Acute myocardial infarction, STEMI network, primary PCI