CorSalud 2019 Apr-Jun;11(2):113-119

CorSalud

Cuban Society of Cardiology

Original Article

Cardiocentro Ernesto Che Guevara Santa Clara Cuba

Non-lethal complications in the acute myocardial infarction: Analysis in a coronary care unit

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Este artículo también está disponible en español

ARTICLE INFORMATION

Received: 1 March 2019
Accepted: April 2, 2019

Competing interests
The authors declare no competing interests

Acronyms
ACS: acute coronary syndrome
AMI: acute myocardial infarction
PCI: percutaneous coronary intervention
STEMI: ST-segment elevation acute myocardial infarction

ABSTRACT

Introduction: Acute Myocardial Infarction is defined as the presence of acute myocardial injury detected by the use of cardiac biomarkers in the demonstrated evidence of acute myocardial ischemia.
Objectives: To evaluate possible factors associated with the appearance of non-lethal in-hospital complications in patients presenting with ST-segment elevation acute myocardial infarction.
Method: An observational, analytical, cross-sectional study was conducted in the Intensive Coronary Care Unit of the "Hospital Clínico-Quirúrgico Manuel Fajardo" in 2016 and 2017. The descriptive statistical method and the necessary statistical tests (χ^2 or Fisher's Exact Test,odds ratio and Student's t-test) were used.
Results: The male sex predominated (59.0%) and the average age was 62 years. Only 41.0% of patients received fibrinolysis. Dyslipidemia showed a statistically significant association with the appearance of complications (p=0.046). Age was related to the appearance of hemodynamic complications (p=0.02). There were no statistically significant differences between patients who received thrombolysis and those who did not, regarding complications (OR=1.33; CI 95%: 0.54-3.24), nor between these and the topography of the infarction (anterior wall OR=0.57; CI 95%: 0.23-1.43; inferior wall OR=1.73; CI 95%: 0.70-4.27).
Conclusions: Dyslipidemia was associated with the appearance of complications in patients with acute myocardial infarction. Age was associated with hemodynamic complications. Thrombolytic therapy and the affected myocardial walls were not related to the occurrence of non-lethal in-hospital complications.
Keywords: Myocardial infarction, Myocardial ischemia, Thrombolytic therapy, Acute coronary syndrome

Complicaciones no letales en el infarto agudo de miocardio: Análisis en una unidad de cuidados coronarios

RESUMEN

Introducción: El infarto agudo de miocardio se define como la presencia de una lesión miocárdica aguda detectada mediante el empleo de biomarcadores cardíacos en el curso demostrado de isquemia miocárdica aguda.
Objetivo: Evaluar probables factores asociados a la aparición de complicaciones intrahospitalarias no letales en pacientes con infarto agudo de miocardio con elevación del segmento ST.

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Método: Se realizó un estudio observacional, analítico, de corte transversal, en la Unidad de Cuidados Coronarios Intensivos del Hospital Clínico-Quirúrgico Manuel Fajardo en 2016 y 2017. Se utilizó el método estadístico descriptivo y las pruebas estadísticas necesarias (χ^2 o prueba exacta de Fisher, razón de probabilidades [odds ratio] y t de Student).
Resultados: Predominó el sexo masculino (59,0%) y la edad media fue de 62 años. Solo el 41,0% de los pacientes recibió fibrinólisis. La dislipidemia presentó asociación estadísticamente significativa con la aparición de complicaciones (p=0,046). La edad se relacionó con la aparición de complicaciones hemodinámicas (p=0,02). No existieron diferencias estadísticamente significativas entre los pacientes que recibieron trombólisis y los que no, respecto a las complicaciones (OR=1,33;IC 95%: 0,54-3,24), ni entre estas y la topografía del infarto (cara anterior OR=0,57;IC 95%: 0,23-1,43; cara inferior OR=1,73; IC 95%: 0,70-4,27).
Conclusiones: La dislipidemia se asoció a la aparición de complicaciones en pacientes con infarto agudo de miocardio; y la edad, con las complicaciones hemodinámicas. La realización de trombólisis y las regiones miocárdicas afectadas no se relacionaron con la aparición de complicaciones intrahospitalarias no letales.
Palabras clave: Infarto de miocardio, Isquemia miocárdica, Terapia trombolítica, Síndrome coronario agudo

INTRODUCTION

Ischemic heart disease is defined as a condition caused by an imbalance between oxygen supply and oxygen demand in the heart[1]. Recently, the fourth universal definition of myocardial infarction was published, bringing together criteria from specialists around the world, especially from the American Heart Society and the European Society of Cardiology. It is described as the presence of acute myocardial injury detected by abnormal cardiac biomarkers in the setting of evidence of acute myocardial ischemia. In turn, these infarctions are classified into various types based on their etiology; those caused by coronary thrombosis belong to group 1[2].

Patients suffering ST-segment elevation acute myocardial infarction (STEMI) may present a series of complications which, in turn, can be classified into hemodynamics (acute heart failure, cardiogenic shock and right ventricular failure), electrical (supraventricular and ventricular tachycardias, atrioventricular blocks, among others) and mechanical (left ventricular free wall/ interventricular septum/ tendinous cord rupture (by papillary muscle necrosis) among others[1,3].

Primary PCI is the reperfusion treatment of choice for patients with acute STEMI presenting within 12 hours of onset of symptoms, when considered feasible within the first 120 minutes following first medical contact by an experienced team. Fibrinolysis or thrombolysis is an alternative reperfusion strategy when primary PCI cannot be delivered[3].

In Cuba, heart disease is the leading cause of death in recent years accounting for 27176 deaths in 2017 representing a rate of 241.6 deaths per 100.000 inhabitants. Of these, 17628 deaths were due to ischemic heart disease (156.7 per 100.000 inhabitants), and 7982 owing to AMI[4].

Ischemic heart disease has a high incidence rate and is generally responsible for a high number of deaths per year, along with AMI in particular. We therefore decided to conduct our research aiming to assess the probable factors associated with the appearance of non-lethal in-hospital complications in patients with STEMI.

METHOD

An observational, analytical, cross-sectional study was performed with enrollment of 105 STEMI patients admitted to the Intensive Coronary Care Unit of the *Hospital Clínico-Quirúrgico Comandante Manuel Fajardo* in 2016 and 2017.

No sampling technique was used, since the whole study population was analyzed.

Inclusion criteria

Patients with STEMI diagnosis admitted to the aforementioned unit.

Exclusion criteria

Patients who were not registered in the unit's data-

base or with insufficient data for further evaluation in the study. Patients who died during their stay in the unit were also excluded.

Variables

Age: Quantitative continuous. Refers to the patient's exact age.

Sex: Qualitative nominal dichotomous. Refers to the subject's biological sex.

Coronary risk factors: Polymorphic nominal qualitative. The following risk factors were studied: age over 65 years, male sex, high blood pressure, smoking, diabetes mellitus, obesity, dyslipidemia and personal pathological history of ischemic heart disease.

Injured myocardial wall: Nominal politomic qualitative. Refers to the topographic location of the AMI recorded in the database.

Thrombolysis performance: Nominal dichotomous qualitative. Refers to whether or not the individual underwent recombinant streptokinase thrombolysis.

Percutaneous coronary intervention: Nominal politomic qualitative. Refers to whether the individual had PCI during admission.

Non-lethal complications: Nominal polymeric qualitative. The following complications were evaluated: hemodynamic, electrical, mechanical, other, and any complication (if the patient had at least one of those evaluated).

Statistical analysis

Data were obtained from a database belonging to the institution's Coronary Intensive Care Unit and subsequently entered into the statistical package SPSS version 18 for thorough evaluation. Both descriptive statistical method and statistical tests were used: χ^2 or Fisher's exact test when less than 80% of the cells in the contingency table reached expected values greater than 5, probability or opportunity ratio (odds ratio) and Student's *t* test for independent samples. Values of $p<0.05$ were considered statistically significant and 95% confidence intervals were calculated.

Ethics

The reliability of the data was strictly preserved and always kept in compliance with the Ethical Principles for Medical Research Involving Human Subjects, adopted by the Declaration of Helsinki and amended by the 52nd General Assembly in Edinburgh in October 2002.

Our research did not require substantial financial or material resources.

Table 1. General characteristics of the patients.

Variable	Nº (%)
Age in years (mean ± SD)	62 ± 12.7
Sex	
Male	62 (59.0)
Female	43 (41.0)
Coronary risk factors	
Ischemic heart disease	16 (15.2)
High blood pressure	67 (63.8)
Diabetes mellitus	19 (18.1)
Dyslipidemia	4 (3.8)
Obesity	19 (18.1)
Smoking	62 (59.0)
Ex-smokers	14 (13.3)
Myocardial wall involvment	
Anterior	47 (44.8)
Inferior	54 (51.8)
Other	4 (3.8)
Thrombolysis	43 (41.0)
Percutaneous coronary intervention	16(15.2)
Complications	
Hemodynamic	10 (9.5)
Electrical	13 (12.4)
Mechanical	1 (1.0)
Other	5 (4.8)
Any complication	26 (24.8)

RESULTS

Table 1 shows the general characteristics of the study population. Male predominance is observed (59%) with an average age of 62 years. The main coronary risk factors were previous high blood pressure (present in 63.8% of the population) and smoking habit (in 59% of the individuals assessed). Inferior wall STEMI prevailed (51.8%), only 41% of patients received streptokinase fibrinolysis and only 15.2% of cases received PCI. In terms of complications, electrical ones predominated (13 patients

[12.4%]), followed by hemodynamic ones (9.5%), and all electrical complications were observed in patients with Inferior wall involvement.

Table 2 shows the analysis of the statistical association between coronary risk factors and the presence of any type of complications in the individuals studied. Only dyslipidemia presented a statistically significant association with the appearance of complications (p=0.046).

The subgroup of patients with hemodynamic complications presented a higher mean age, with a statistically significant association (p=0.02) with respect to uncomplicated patients (**Table 3**).

No statistically significant differences were found between patients who received thrombolysis and those who did not after applying the Cross-Product Method (**Table 4**).

No statistically significant differences were seen when analyzing the risk of complications according to the infarction topography (**Table 5**).

Table 2. Association between coronary risk factors and the appearance of complications.

Variable	Complications		p
	Yes	No	
Age > 65 years	13	26	0.118
Male	14	48	0.534
Personal pathological history			
Ischemic heart disease	4	12	1.000*
High blood pressure	16	51	0.781
Diabetes mellitus	7	12	0.239*
Dyslipidemia	3	1	0.046*
Obesity	7	12	0.239*
Smoking	16	46	0.403

* Fisher's exact test was used.

Table 3. Student's *T* test for association between age and complications.

Complications	Mean age		p
	Complicated	Uncomplicated	
Hemodynamic	71.3	61.5	0.020
Electrical	65.5	62.0	0.360
Any complication	66.0	61.3	0.106

Table 4. Prediction of risk of complications related to thrombolysis treatment (n=43).

Complication	Nº	OR (IC 95%)
Hemodynamic	4	0.96 (0.25 - 3.62)
Electric	7	1.82 (0.56 - 5.84)
Any complication	12	1.33 (0.54 - 3.24)

DISCUSSION

Acute Myocardial Infarction is considered to be a serious cardiovascular event during outcome and follow-up in patients with a diagnosis of ischemic heart disease and is also deemed as one of the leading causes of death worldwide[1,3].

Findings like male predominance/mean age over 60 years mirrored that of several national and foreign studies[5-11].

A recent Spanish study showed a lower survival rate in STEMI patients aged over 75 years, as age was associated with the appearance of both in-hospital and late complications; in addition, this group received lower doses of beta-blockers and were referred for PCI in smaller numbers[12].

In a study carried out in Cuba, Santos *et al* [7] demonstrated that diabetes mellitus and hypertension behaved as prognostic factors of in-hospital mortality in patients with STEMI which, somehow, contradicts our current results. Another research in Granma conducted in hypertensive patients confirmed dyslipidemia, obesity, male sex and smoking as coronary risk factors[13].

Santos *et al* [14], in another study, concluded that the history of ischemic heart disease, obesity and the combination of high blood pressure with age over 70 years were predictors of serious cardiovascular events in patients with STEMI.

In a Japanese study, recently published in Atherosclerosis, familial hypercholesterolemia (hereditary dyslipidemia) was statistically associated with premature death from acute coronary syndrome[15].

The prevalence of electrical complications in our series was similar to several studies[6,8,16,17]. In contrast to this, Berenstein *et al* [18] in an Argentinean study reported a predominance of hemodynamic

Table 5. Prediction of risk of complications related to the infarction topography.

Location of infarction	Type of complication	Nº	OR (IC 95%)
Anterior wall (n=47)	Hemodynamic	7	3.21 (0.78 - 13.17)
	Any complication	9	0.57 (0.23 - 1.43)
Inferior wall (n=54)	Hemodynamic	2	0.21 (0.04 - 1.03)
	Any complication	16	1.73 (0.70 - 4.27)

complications and, within this group, highlighted heart failure, found in 19.1% of patients. Santos *et al*[7], in one of their articles, concluded that among the non-lethal complications, hemodynamic complications were the most frequent, and found some degree of heart failure during hospital stay in a 40% of patients discharged alive; on the other hand, cardiogenic shock was the most frequent among deceased, being present in 67.3% of them.

Likewise, these complications were found to be the most frequent in other studies[19-23].

The primary therapeutic objective in STEMI is early reperfusion of the myocardium with acute ischemia and in the setting of infarction[24]. In contrast to several articles, our research evidenced a clear predominance of patients who did not receive reperfusion therapy, although it was not related to the appearance of complications due to the reduced sample size. Fernández *et al*[25], in another Argentine study, found that 89.3% of their cases received some primary reperfusion therapy; in 61.7% of these, PCI was the chosen strategy. An investigation in Pinar del Río, carried out in a secondary care center, revealed that 55.2% of the patients underwent fibrinolysis[17].

Martínez *et al*[20], in an investigation carried out in the emergency department of a tertiary level institution, highlighted that 29.9% of the patients studied had primary PCI and 49% received fibrinolytic therapy, where PCI was associated with fewer complications. Another Cuban study showed that fibrinolysis is not a good predictor of in-hospital complications, whereas mechanical reperfusion was associated with fewer events[21]. A Spanish trial also showed similar results in terms of PCI advantages[26]. However, a study carried out by Rodríguez-Londres *et al*[10] concluded that there were no marked differences in mortality between patients undergoing pharmacological reperfusion and those undergoing mechanical reperfusion.

The low number of PCI observed in this study was due to the fact that this center does not have an Interventional Cardiology Unit, therefore, primary mechanical reperfusion is not an available therapeutic option for patients. This method is reserved for cases with poorer prognosis or serious complications who receive it after prior coordination with another medical center.

The PRIAMHO study showed that administration of thrombolysis is associated with a less complicated clinical course and reduced mortality within 28 days after the AMI occurred[27]. The GESIR 5 study demonstrated that these advantages of thrombolysis persist 4 years after the event[28].

Some fibrinolytic agents, widely more recommended today, such as alteplase (tissue plasminogen activator [t-PA]) and its variants (tenecteplase and others) which are associated with fewer deaths and better prognosis, have far outstripped streptokinase (used in this study)[3,29,30].

In terms of topography, our results coincide with those of Martínez García and Ravelo Dopico[21], in whose study the inferior wall was predominantly involved (48.5%) and there was no association between the infarcted territory and the appearance of complications. Other studies also showed inferior wall predominance[5,8,20,31].

Some limitations of the present trial warrant consideration; as it is cross-sectional, it is difficult to establish a causal relationship between the statistically associated factors. Furthermore, having a relatively small study population may interfere with the statistical analysis performed, although it may serve as a starting point for other larger-scale research to assess the time elapsed until the onset of complications.

CONCLUSIONS

Dyslipidemia was the only risk factor associated with non-lethal complications in patients with acute myocardial infarction. Age showed significant statistical association with the occurrence of haemodynamic complications. Thrombolysis, as reperfusion therapy, and infarction topography were not associated with non-lethal in-hospital complications.

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