




Cardiovascular risk factors in patients with ST-segment elevation myocardial infarction

Chen Shang¹, MD, MSc; Damaris Hernández Véliz^{2,3}, MD, MSc; Marlene Ferrer Arrocha^{1,3} 
MD, PhD; Maylín I. Alonso Martínez^{1,3} , MD, MSc; and Héctor Pérez Assef^{3,4} , MD, MSc

¹ Centro de Investigaciones y Referencias de Aterosclerosis de la Habana (CIRAH). Havana, Cuba.

² Department of Cardiology, Instituto de Cardiología y Cirugía Cardiovascular. Havana, Cuba.

³ Universidad de Ciencias Médicas de La Habana. Havana, Cuba.

⁴ Intensive Care Unit, Hospital Clínico Quirúrgico Hermanos Ameijeiras. Havana, Cuba.

Este artículo también está disponible en español

ARTICLE INFORMATION

Received: June 11, 2019

Accepted: August 8, 2019

Competing interests

The authors declare no competing interests

Abbreviations

ACS: acute coronary syndrome

AMI: acute myocardial infarction

STEMI: ST-segment elevation myocardial infarction

ABSTRACT

Introduction: Coronary artery disease is the first cause of death in the Western world, making it a huge public health problem of global significance.

Objective: To describe the cardiovascular risk factors in patients diagnosed with ST-segment elevation myocardial infarction.

Method: We conducted a cross-sectional descriptive study encompassing 246 patients with diagnosis of ST-segment elevation myocardial infarction admitted to the Coronary Intensive Care Unit of the Instituto de Cardiología y Cirugía Cardiovascular over the period June 2016 to June 2017.

Results: Male patients and the age group of 60 years and older predominated. The main atherogenic risk factors found were high blood pressure (71.1%) and smoking (63.8%). Inferior wall location and electrical complications predominated over mechanical ones. Mortality during admission to the Coronary Intensive Care Unit was 4.4%. Diabetes mellitus was the atherogenic risk factor more associated with adverse events with an OR of 10,628 (CI 4.168 – 27.075).

Conclusions: Elderly male patients predominated. The most frequent atherogenic risk factor was high blood pressure and the risk of presenting cardiovascular adverse events was higher in diabetics.

Keywords: Acute coronary syndrome, Myocardial infarction, Risk Factors, Atherosclerosis, High blood pressure, Diabetes mellitus

Factores de riesgo cardiovascular en pacientes con infarto agudo de miocardio con elevación del segmento ST

RESUMEN

Introducción: La enfermedad coronaria es la causa número uno de muerte en el mundo occidental, por lo que constituye un enorme problema de salud pública de trascendencia mundial.

Objetivo: Describir los factores de riesgo cardiovascular en los pacientes con diagnóstico de infarto agudo de miocardio con elevación del segmento ST.

Método: Se realizó un estudio descriptivo de tipo transversal que incluyó a 246 pacientes con diagnóstico de infarto agudo de miocardio con elevación del segmento ST, ingresados en la Unidad de Cuidados Intensivos Coronarios del Instituto de Cardiología y Cirugía Cardiovascular, durante el período de junio de 2016 a junio de 2017.

✉ M Ferrer Arrocha
CIRAH – Policlínico 19 de abril.
Tulipán y Panorama, Nuevo Vedado,
Plaza de la Revolución 10600.
La Habana, Cuba.
E-mail address:
marlene.ferrer@infomed.sld.cu

Authors' contribution

CS y MFA: Idea conception and design of the research; data collection, analysis and interpretation; and manuscript writing. DHV y MAM: Conception of the research; statistical analysis and interpretation of raw data. HPA: Performed data collection, and helped to draft the manuscript. All authors critically reviewed the manuscript and approved the final report.

Resultados: Predominaron los pacientes del sexo masculino y el grupo de edad de 60 y más años. Los principales factores de riesgo aterogénico encontrados fueron la hipertensión arterial (71,1%) y el tabaquismo (63,8%). Predominó la localización de cara inferior y las complicaciones eléctricas sobre las mecánicas. La mortalidad durante el ingreso en la Unidad de Cuidados Intensivos Coronarios fue de un 4,4%. El factor de riesgo aterogénico que presentó mayor asociación con los eventos adversos fue la diabetes mellitus con un OR de 10,628 (IC 4,168 - 27,075).

Conclusiones: Predominaron los pacientes ancianos del sexo masculino. El factor de riesgo aterogénico más frecuente fue la hipertensión arterial y el riesgo para presentar eventos adversos cardiovasculares fue mayor en los diabéticos.

Palabras clave: Síndrome coronario agudo, Infarto de miocardio, Factores de riesgo, Aterosclerosis, Hipertensión arterial, Diabetes mellitus

INTRODUCTION

Coronary artery disease is the number one cause of death in the Western world, making it a huge public health issue of global significance¹. Ischemic heart disease, and specifically acute myocardial infarction (AMI) takes a large toll on the human population. Cuba is not spared from this scourge either and statistics clearly indicate that heart disease is the leading cause of death, including AMI, representing nearly 82% and accounting for almost 25% of the country's mortality rate, or in other words, one out of every four people in Cuba dies from AMI².

At present, several studies with well-established methodologies engage in epidemiological surveillance of heart disease by taking the AMI as their main measure, based primarily on three elements: chest pain, electrocardiographic screening and alterations in cardiac enzymes (or markers of myocardial injury). Each of these epidemiological surveillance programmes offers different perspectives on this important problem, providing complementary epidemiological information³.

Acute coronary syndrome (ACS) is an especially useful operational term in the assessment of patients with chest pain that is used to refer to any group of clinical symptoms compatible with acute myocardial ischemia. The ACS comprises any type of AMI, with or without ST-segment elevation, as well as unstable angina. In practice, ACS is classified into two groups of patients: individuals who have an ST-segment elevation myocardial infarction (STEMI) having an indication for immediate reperfusion, and individuals with non ST-segment elevation, including those with non ST-segment elevation acute myocardial infarction and unstable angina^{4,5}.

People suffering from persistent chest pain or other symptoms indicative of ischemia and ST-segment elevation in at least two adjacent leads are classified as STEMI patients⁶. Currently, the number of ACS without persistent ST-segment elevation admissions, outnumbers that of persistent ST-segment elevation admissions. The GRACE registry enrolled 10.693 ACS patients between 1999 and 2001 across Europe, America, Australia and New Zealand, and in that study, two-thirds of the total were non ST-segment elevation electrocardiogram patients⁷.

According to (INTERHEART) a global case-control study of risk factors for acute myocardial infarction, nine easily measurable and modifiable risk factors accounted for over 90% of the initial AMI risk and can be summarized in: smoking, high serum lipid levels, high blood pressure, diabetes mellitus, morbid obesity, sedentary lifestyle, low daily intake of fruits and vegetables, troublesome alcohol consumption and psychosocial index⁸. Both men and women suffer from its effects across different geographical regions and ethnic groups being therefore applicable worldwide.

Some recent studies have highlighted a decrease in acute and long-term mortality after STEMI related to an increase in reperfusion therapy, primary percutaneous coronary intervention (PCI), modern antithrombotic treatment and secondary prevention. However, mortality continues to be high.

Coronary artery disease is the most relevant clinical and health problem of atherosclerosis and presents a high morbidity and mortality due to ST-segment elevation acute coronary syndrome. That is why the authors of this paper set out to describe some cardiovascular risk factors in patients who were treated in the Coronary Intensive Care Unit.

METHOD

A descriptive cross-sectional type study was conducted including all patients with STEMI admitted to the Coronary Intensive Care Unit of the *Instituto de Cardiología y Cirugía Cardiovascular*, Havana, Cuba, in the time frame of June 2016 to June 2017. All cases whose medical records lacked the data required for the completion of the study were discarded, so that in the end, the sample was made up of 246 patients.

The data were entered into the primary data collection model of the *Centro de Investigaciones y Referencia de Aterosclerosis de la Habana* (CIRAH), and the sections related to sociodemographic and clinical variables were analyzed.

Socio-demographic variables

Sex: according to biological sex.

Age: (in years) three groups were set up for analysis: 20-39, 40-59 and 60 onwards.

Clinical variables

History of cardiovascular risk factors in the medical record.

- Smoking: any patient who currently smokes or has smoked in the last 12 months.
- Hypertension: whether a history of hypertension is recorded or oral antihypertensive medication is taken.
- Dyslipidemia: whether a history of hypercholesterolemia or hypertriglyceridemia is reported or

complementary analyses in his medical record, showing elevation of total cholesterol with figures above 5.2 mmol/l or of triglycerides above 1.7 mmol/l, were also found.

- Overweight or obesity: according to BMI values: 25-29.9 kg/m² of body surface for the former and ≥30 kg/m² for the latter.
- History of AMI: yes, or no.
- Presence of adverse events: yes, or no. We considered any cardiac complication occurred during admission and expressed in clinical records such as: arrhythmias, cardiogenic shock, reinfarction, cardiorespiratory arrest, acute pulmonary edema and mechanical complications.
- Death: occurred during hospital admission.

Statistical processing

All the information collected was entered into an Excel database and the data was further processed with the help of the SPSS statistical package version 18.0 for Windows.

Qualitative variables were grouped together into absolute numbers and percentages, and for quantitative variables, descriptive statistical methods such as mean and standard deviation were applied. The results are shown in frequency tables and graphs.

To compare discrete qualitative and quantitative variables and to establish relationships between variables the different options of the Chi-square test were used with a 95% significance level; and to quantify a possible risk, the cross product test or probability index (odds ratio) was applied with a 95% confidence interval calculated by the Woolf method.

Table 1. Population distribution by sex and age groups.

Age groups (Years)	Female		Male		TOTAL	
	Nº	%	Nº	%	Nº	%
20 – 39	0	0	1	100	1	0.4
40 – 59	24	51.1	23	48.9	47	19.1
60 and over	61	30.8	137	69.2	198	80.5
Total	85	34.6	161	65.4	246	100

Ethical issues

All data were extracted from medical records and used solely for research purposes.

RESULTS

The mean age of the patients studied was found to be 64 ± 11.8 years. A prevalence of the male group of 60 years and older was evident (**Table 1**).

The most frequent atherogenic risk factors were high blood pressure (71.1%), closely followed by smoking and overweight/obesity (63.8%). It is important to mention that 14.2% of the patients had a history of AMI at current admission (**Table 2**).

The **figure** describes immediate adverse cardiovascular events including the presence of complications and death in hospital. Complications occurred in 15.4% of patients and 11 (4.4%) died.

After an in-depth analysis of the association between risk factors and adverse events, we found that the cardiovascular risk factor with the strongest association was diabetes mellitus, accounting for 10.6 times the risk, followed by dyslipidemia (OR 4.93) and high blood pressure (OR 3.19), while smoking did not pose a risk (**Table 3**).

DISCUSSION

A characterization of patients diagnosed with ST-segment elevation acute coronary syndrome, admit-

Table 2. Patients' distribution according to risk factor frequency.

Risk Factors	n	%
Smoking	157	63.8
Diabetes mellitus	88	35.8
High blood pressure	175	71.1
Dyslipidemia	96	39.0
Overweight/obesity	155	63.0
Previous myocardial infarction	35	14.2

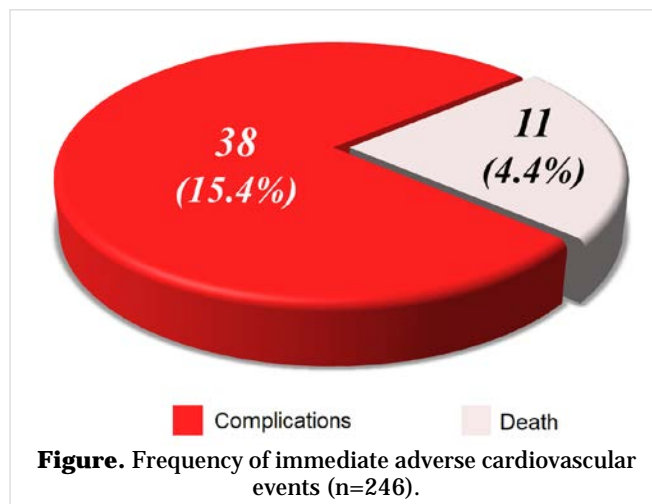


Table 3. Relationship between cardiovascular risk factors and adverse events.

Risk Factor	Adverse Event				Odd Ratio (OR)	Confidence interval
	No		Sí			
	Nº	%	Nº	%		
Diabetic (n=88)	62	70.5	26	29.5	10.62	4.16 - 27.07
High blood pressure (n=175)	147	84.0	28	16.0	3.19	1.07 - 9.45
Dyslipidemia (n=96)	73	76.0	23	24.0	4.93	2.17 - 11.21
Smoking (n=157)	140	89.2	17	10.8	0.59	0.28 - 1.26
Overweight/Obesity (n=155)	133	85.8	22	14.2	1.34	0.60 - 2.97

ted to a specialized unit, was performed in the above study. Our results are consistent with different publications in the national and international field, with respect to the distribution by sex and age. In a study held at the Institute of Cardiology and Cardiovascular Surgery from 2009 to 2013, Franco *et al*⁹ detected a predominance of the male sex (72.4%) with respect to the female sex (27.6%); the average age of onset in women was later than that in men and the most representative age group was 60-69; which coincides with del Pino *et al*¹⁰ in another study, carried out at the same institution, in 2011.

Both age and sex risk factors for cardiovascular disease have been widely explored. It is universally known that the proportion of patients with ischemic heart disease is higher in men; however, this difference is wiped out in the case of menopausal women by the loss of the estrogenic protection they had in pre-menopausal age. Aging brings about a change in the pattern of risk factors in patients: As the influence of family history decreases, smoking, hypercholesterolemia, high blood pressure and diabetes mellitus become much more frequent¹¹.

A study, undertaken in 52 countries (INTERHEART), addressing the effect of potentially modifiable risk factors associated with AMI, showed that about 50% of the population's risk of AMI was attributable to the lipid profile and 25% to high blood pressure¹². However, the cardiovascular risk factors most frequently found in our study results were high blood pressure followed by smoking and overweight.

In a 2014 report by the American Heart Association, high blood pressure was ranked as the main percentage risk factor for cardiovascular disease, with 40.6%; followed by tobacco consumption (13.7%), unhealthy eating (13.2%), physical inactivity (11.9%) and abnormal blood glucose levels (8.8%)¹³⁻¹⁶.

Regarding the modifiable risk factors studied, we can assert that they all have been associated with a worse prognosis, except for smoking, as evidenced by the results of the current research. A paradoxical effect of tobacco consumption on early mortality has been described for non-smokers. Some possible mechanisms are thought to be the presence of a more favorable lipid profile, higher values of fibrinogen and platelets that would produce a state of hypercoagulability related to earlier-stage infarctions with milder coronary disease and more frequent

spontaneous reperfusion¹⁷.

A study by Mani *et al*¹⁸ in India highlighted that diabetic patients with glycated hemoglobin (HbA1c) levels greater than 7% displayed a higher proportion of unstable angina, STEMI, heart failure, accelerated hypertension, dilated cardiomyopathy and three-vessel disease than those with HbA1c<7%. On the other hand, individuals with diabetes mellitus in the general population are at increased risk of sudden cardiac death, primarily due to malignant ventricular arrhythmias in an ACS scenario. In a meta-analysis comprising 15 studies¹⁹, cardiovascular autonomic neuropathy was significantly associated with an increased risk of mortality. It has been demonstrated that even in patients without a diagnosis of diabetes mellitus, hyperglycemia at the onset of presentation of AMI is significantly related to mortality and reinfarction after 30 days^{6,19,20}.

The diabetic group has a worse prognosis among patients with confirmed ischemic heart disease. This can be attributed to the fact that they have a higher incidence of multiple vessel disease and more extensive disease in each artery²⁰.

Despite the increased prevalence of ischemic heart disease in recent years, studies report a decrease in mortality from STEMI, related to the use of reperfusion therapy, primary percutaneous coronary intervention, modern antithrombotic treatment and secondary prevention. However, this disease is among the leading causes of death in those countries where infections are not predominant, including Cuba, so further research is required, paying special attention to primary prevention activities.

CONCLUSIONS

We found that ST-segment elevation acute coronary syndrome occurred more frequently in males and in the age group over 60 years. The main risk factors detected were smoking and high blood pressure while diabetes mellitus was mostly associated with complications and mortality.

REFERENCES

1. Mozaffarian D, Benjamin EJ, Go AS, Arnett DK,

- Blaaha MJ, Cushman M, *et al.* Heart Disease and Stroke Statistics-2016 Update: A Report From the American Heart Association. *Circulation*. 2016; 133(4):e38-360. Available at: <http://circ.ahajournals.org/content/circulationaha/133/4/e38.full.pdf>
2. Ministerio de Salud Pública. Anuario Estadístico de Salud 2015. La Habana: Dirección Nacional de Registros Médicos y Estadísticas de Salud; 2016.
 3. Roger VL. Epidemiology of myocardial infarction. *Med Clin North Am*. 2007;91(4):537-52.
 4. Antman EM, Anbe DT, Armstrong PW, Bates ER, Green LA, Hand M, *et al.* ACC/AHA guidelines for the management of patients with ST-elevation myocardial infarction—executive summary. A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to revise the 1999 guidelines for the management of patients with acute myocardial infarction). *J Am Coll Cardiol*. 2004; 44(3):671-719.
 5. Thygesen K, Alpert JS, Jaffe AS, Chaitman BR, Bax JJ, Morrow DA, *et al.* Fourth Universal Definition of Myocardial Infarction (2018). *J Am Coll Cardiol*. 2018;72(18):2231-64.
 6. Ibáñez B, James S, Agewall S, Antunes MJ, Bucciarelli-Ducci C, Bueno H, *et al.* Guía ESC 2017 sobre el tratamiento del infarto agudo de miocardio en pacientes con elevación del segmento ST. *Rev Esp Cardiol [Internet]*. 2017 [cited 7 Jun 2019]; 70(12):1082.e1-e61. Available at: <https://www.revespcardiologia.org/es-pdf-S0300893217306693>
 7. Goldberg RJ, Steg PG, Sadiq I, Granger CB, Jackson EA, Budaj A, *et al.* Extent of, and factors associated with, delay to hospital presentation in patients with acute coronary disease (the GRACE registry). *Am J Cardiol*. 2002;89(7):791-6.
 8. Rosamond WD, Chambless LE, Folsom AR, Cooper LS, Conwill DE, Clegg L, *et al.* Trends in the incidence of myocardial infarction and in mortality due to coronary heart disease, 1987 to 1994. *N Engl J Med*. 1998;339(13):861-7.
 9. Franco MR, Sainz B, Ramos B, Frías JA. Caracterización de pacientes con infarto agudo del miocardio con elevación del segmento ST. *Rev Cuban Cardiol [Internet]*. 2015 [cited 8 Jun 2019]; 21(1):16-23. Available at: <http://revcardiologia.sld.cu/index.php/revcardiologia/article/view/565/732>
 10. Del Pino E, Pérez del Todo JM, Quiroz JJ, Sánchez N, Rodríguez V. Diferencias por sexo del síndrome coronario agudo sin elevación del segmento ST en la Unidad de Cuidados Coronarios. *Rev Cuban Cardiol [Internet]*. 2011 [cited 8 Jun 2019];17(4):304-10. Available at: <http://revcardiologia.sld.cu/index.php/revcardiologia/article/view/81/142>
 11. Martínez A, Sainz BA, Ramos B, Pacheco E, Zorio BY, Castañeda G. Infarto agudo con elevación del ST en el servicio de urgencias del Instituto de Cardiología. *Rev Cuban Cardiol [Internet]*. 2017 [cited 8 Jun 2019];23(1). Available at: http://revcardiologia.sld.cu/index.php/revcardiologia/article/view/677/pdf_76
 12. Lanús F, Toro V, Cortés R, Sánchez A. Interheart, un estudio de casos y controles sobre factores de riesgo de infarto del miocardio en el mundo y América Latina. *Médicas UIS*. 2008;21(3):176-82.
 13. Go AS, Mozaffarian D, Roger VL, Benjamin EJ, Berry JD, Blaaha MJ, *et al.* Executive summary: Heart disease and stroke statistics – 2014 update: A report from the American Heart Association. *Circulation*. 2014;129(3):399-410.
 14. Lira MT. Impacto de la hipertensión arterial como factor de riesgo cardiovascular. *Rev Med Clin Condes*. 2015;26(2):156-63.
 15. Valdés Ramos ER, Rivera Chávez M, Bencosme Rodríguez N. Comportamiento del infarto agudo del miocardio en personas con diabetes mellitus de la provincia Granma. *Rev Cuba Endocrinol [Internet]*. 2012 [cited 9 Jun 2019];23(2):128-38. Available at: <http://scielo.sld.cu/pdf/end/v23n2/end03212.pdf>
 16. García Mena LM, Ramírez Gómez JI, Llanes Camacho MC, Jiménez Trujillo JA, Alegret Rodríguez M. Estudio de la cardiopatía isquémica en pacientes menores de 45 años. *CorSalud [Internet]*. 2009 [cited 10 Jun 2019];1(4). Available at: <http://www.corsalud.sld.cu/sumario/2009/v1n4a09/estudio.htm>
 17. Santos M, Barreiro A, García RC, Barreiro AE. Factores de riesgo de mortalidad hospitalaria post infarto agudo de miocardio. *Rev Cuban Cardiol [Internet]*. 2017 [cited 10 Jun 2019];23(3). Available at: http://www.revcardiologia.sld.cu/index.php/revcardiologia/article/view/710/pdf_91
 18. Mani VE, John M, Calton R. Impact of HbA1c on acute cardiac states. *J Assoc Physicians India*. 2011;59:356-8.
 19. Balcioglu AS, Müderrisoğlu H. Diabetes and car

- diac autonomic neuropathy: Clinical manifestations, cardiovascular consequences, diagnosis and treatment. *World J Diabetes*. 2015;6(1):80-91.
20. Savonitto S, Morici N, Cavallini C, Antonicelli R, Petronio AS, Murena E, *et al*. One-year mortality in elderly adults with non-ST-elevation acute coronary syndrome: effect of diabetic status and admission hyperglycemia. *J Am Geriatr Soc*. 2014; 62(7):1297-303.