Clinical Profile, Predictors of Mortality, and Treatment of Patients after Myocardial Infarction, in an Academic Medical Center Hospital

Leonardo A. M. Zornoff, Sérgio A. R. Paiva, Vanessa M. Assalin, Patrícia M. S. Pola, Luís E. Becker, Marina P. Okoshi, Luiz S. Matsubara, Roberto M. T. Inoue, Joel Spadaro

Botucatu, SP - Brazil

Objective *- To evaluate clinical profiles, predictors of 30-day mortality, and the adherence to international recommendations for the treatment of myocardial infarction in an academic medical center hospital.*

Methods *- We retrospectively studied 172 patients with acute myocardial infarction, admitted in the intensive care unit from January 1992 to December 1997.*

Results *- Most patients were male (68%), white (97%), and over 60 years old (59%). The main risk factor for coronary atherosclerotic disease was systemic blood hypertension (63%). Among all the variables studied, reperfusion therapy, smoking, hypertension, cardiogenic shock, and age were the predictors of 30-day mortality. Most commonly used medications were: acetylsalicylic acid (71%), nitrates (61%), diuretics (51%), angiotensin-converting enzyme inhibitors (46%), thrombolytic therapy (39%), and beta-blockers (35%).*

Conclusion *- The absence of reperfusion therapy, smoking status, hypertension, cardiogenic shock, and advanced age are predictors of 30-day mortality in patients with acute myocardial infarction. In addition, some medications that are undoubtedly beneficial have been underused after acute myocardial infarction.*

Key words: myocardial infarction, mortality, treatment

Faculdade de Medicina de Botucatu - UNESP
Mailing address: Leonardo A. M. Zornoff – Depto. de Clínica Médica – Faculdade de Medicina de Botucatu – Rua Rubião Júnior S/N - 18618-000 - Botucatu, SP
E-mail: lzornoff@fmb.unesp.br

Acute myocardial infarction is responsible for a great number of hospital stays all over the world and for a great number of deaths [1,2]. Several variables have been used to predict the evolvement and to guide the treatment of patients with acute myocardial infarction. Those that stand out are age, sex, hypertension or hypotension, diabetes, size and location of the infarction, hypotension, ventricular dysfunction, left ventricle dimensions, and the level of neurohormonal activation [3-5].

In recent years, new therapeutical interventions were introduced based on the evidences of major clinical trials that reduced morbidity and enhanced survival after acute myocardial infarction. Among these strategies, are the use of reperfusion therapy, antiplatelet agents, angiotensin-converting enzyme inhibitors, and beta- blockers [6-9].

However, reports from the literature suggest that a great number of patients with acute myocardial infarction may not be receiving the recommended treatment [10-12]. This phenomenon may be due to the characteristics of the hospitals in which the patient with the myocardial infarction is admitted, as well as patient's peculiarities [13,14].

This study aimed at evaluating the clinical profile of patients with a diagnosis of acute myocardial infarction, seen at an academic medical center hospital in the countryside area of the State of São Paulo. Additionally, we have assessed the adherence to current recommendations for the treatment of acute myocardial infarction, and identified the variable predictors of 30-day mortality after admittance.

Methods

We retrospectively assessed the charts of patients admitted to the intensive care unit of the Hospital das Clínicas da Faculdade de Medicina de Botucatu, UNESP, from January 1992 to December 1997. In this period, 211 patients were admitted with acute myocardial infarction, confirmed by combinations of precordial pain and/or electrocardiogra-

phic alterations and a serum increase ~~of~~ in cardiac enzymes. After reviewing the charts, we selected 172 patients who had the necessary information required for the study protocol.

Regarding clinical profiles, data were obtained from the history and physical examinations at admission. Study variables were: age, sex, race, heart rate, systemic blood pressure, electrocardiographic location of the infarction (anterior, inferior, other), and cardiac enzymes.

With respect to risk factors, family history was investigated, as well as smoking status, and also the occurrence of hypertension, diabetes, and dyslipidemia. These variables were classified as traditional risk factors. Positive family history included those who had first-degree relatives or 2 previous generations. Smokers were defined as those patients who smoked daily regardless of the number of cigarettes smoked. Diabetes patients were classified as those who, in previous examinations and during admittance, had a fasting blood glucose concentration compatible with the diagnosis. Hypertension was considered in those who had this diagnosis prior to the acute myocardial infarction. Dyslipidemia was determined by the presence of increased serum levels of low density lipoproteins and/or decreased serum levels of high density lipoproteins. The risk factor obesity was not included due to this variable not being indicated in the chart.

Concerning the complications experienced by the patients during their stay in the intensive care unit, the diagnoses that were found in the charts were accepted. If certain information, such as report of cardiogenic shock or congestive heart failure, was missing, it was considered as nonexistent.

The 10 most frequently prescribed classes of medication during admittance in the intensive care unit were evaluated concerning the percentage of use, considering only those drugs used for at least 48 hours.

Regarding the statistical analysis, patients were divided into 2 groups, survivors and nonsurvivors. To study continuous variables, we used the student's *t* test and Mann-Whitney test, whereas, to study dichotomous variables, we used the chi-square test. Variables that could predict the patients' evolvement during the one-month follow-up period were identified using a multivariable analysis (multiple logistic regression study). $P<0.05$ was considered statistically significant.

Results

Duration of precordial pain, from the onset of symptoms up to the moment of the first assessment in the emergency room, was 10.6±15 hours. The characteristics of the patients when diagnosis of acute myocardial infarction was obtained are shown in table I. The analysis of the charts allowed determination of the race of 159 patients, the blood pressure (diastolic, systolic, and mean) of 171 patients, and the heart rate of 161 patients. The other variables could be recovered in 172 patients. In the 30-day period after admittance to the intensive care unit, the statistical analysis of those variables demonstrated that the mortality rate was higher in older patients (69.7±9.6 years) than in younger ones (58.8±11.1 years) ($P<0.001$). Likewise, surviving patients had heart rates statistically lower on admission than those who died later. The other variables, sex, race, blood pressure, creatine kinase (CK), MB isoenzymes (CKMB), and location of the infarction were not statistically different between the two groups. During the 30-day observation period, 39 (22%) patients died.

Variables that are usually used as indicators of a poor prognosis after myocardial infarction are listed in table II. Some data were statistically different between the surviving and deceased patients. Of the deceased patients, 43.6% (17 out of 39) had cardiac arrhythmias, but only 22.6% (30 out of 133) of the surviving patients had sustained arrhythmias ($P=0.02$). Cardiogenic shock was seen in 43.6% (17 out of 39) of the deceased patients and in 2.3% (3 out of 133) of the surviving patients ($P=0.001$).

Table III presents data concerning risk factors for coronary disease. Considering all the patients included in our study, 93.7% of the patients had at least one classical risk factor. The variables were family history of coronariopathy, presence of dyslipidemia, smoking status, hypertension, and diabetes mellitus. The only variable that was statistically different between the 2 groups was smoking status. Thus,

Table I – Characteristics of the patients with acute myocardial infarction in the first assessment

	Survivors (n=133)	Nonsurvivors (n=39)	Significance
Age	59±1	70±9	<0.001
Male	67.6%	61.5%	0.6
White	97.1%	96.7%	0.66
HR (bpm)	80 (64-91)	88 (75-104)	0.02
MBP (mm Hg)	93 (83-104)	103 (90-117)	0.09
CK (UI/mL)	550 (326-937)	537 (302-877)	0.75
CKMB (UI/mL)	62 (38-116)	75.5 (26-119)	0.88
AMI Location			0.09
Anterior	47%	25%	
Inferior	37%	47%	
Other	16%	28%	

AMI- acute myocardial infarction; HR- heart rate; MBP- mean blood pressure; CK- creatine kinase; CKMB- MB isoenzyme; bpm- beats per minute. Values concerning age are expressed in mean ± standard deviation; values concerning FC, MBP, CK, and CKMB are expressed by the median and 25th and 75th percentiles.

Table II – Complications after acute myocardial infarction

	% Total	Survivors (n=133)	Nonsurvivors (n=39)	Significance
Angina	12%	14.3%	5.1%	0.21
CHF	30%	25.5%	38.5%	0.17
Hypotension	20%	16.5%	25.6%	0.29
Cardiogenic shock	12%	2.3%	43.6%	0.001
Pericarditis	5%	4.5%	7.7%	0.71
Arrhythmias	27%	22.6%	43.6%	0.02

CHF- cardiac heart failure.

Table III – Traditional risk factors for atherosclerotic heart disease

	% Total	Survivors (n=133)	Nonsurvivors (n=39)	Significance
Smoking	56%	62.4%	33.3%	0.002
Diabetes mellitus	26%	24.8%	30.7%	0.59
Hypertension	63%	61.6%	69.2%	0.5
Family history	19%	22.5%	7.7%	0.07
Dyslipidemias	17%	20.3%	5.1%	0.047

Many factors exist turning it of difficult access for acute myocardial infarction patients.

33.3% (13 out of 39) of the smokers died, while 62.4% (83 out of 133) survived (P = 0.002). Table IV presents the data related to the treatment used in patients during admittance to the intensive care unit. Additional drugs used: acetylsalicylic acid, diuretics, antiarrhythmic drugs, calcium channel blockers, angiotesin-converting enzyme inhibitors, anticoagulants, and nitrates, were not associated with significant changes between the groups compared.

Among all the variables studied (clinical features, risk factors, complications, and treatment), the use of thrombolytic therapy and smoking resulted in higher survival rates in the 30-day period. On the other hand, systemic blood hypertension, cardiogenic shock, and advanced age resulted in increased mortality in the study period (fig. 1).

Discussion

The main findings of our study, in which we analyzed clinical profiles, predictors of 30-day mortality, and the treatment of patients with acute myocardial infarction in an academic medical center hospital, were 1) 30-day mortality was 22%; 2) patients with acute myocardial infarction have the same clinical profile in small cities as patients in the great urban areas; 3) thrombolytic therapy, smoking status, hypertension, cardiogenic shock, and age were the predictors of 30-day mortality; 4) drugs recommended as standard treatment of for acute myocardial infarction, such as thrombolytic therapy, acetylsalicylic acid, and beta-blockers, are underused; 5) drugs used for the treatment of congestive heart failure after acute myocardial infarction, such as diuretics, nitrates, angiotensin-converting enzyme inhibitors, and inotropic drugs, are prevalent.

Table IV – Therapeutics used during Intensive Care Unit stay

	% of use total	Survivors (n=133)	Nonsurvivors (n=39)	Significance
Thrombolytic therapy	39%	45.9%	15.4%	0.001
ASA	71%	73.7%	61.5%	0.2
Nitrates	61%	61.5%	60.9%	0.91
Beta blockers	35%	40.6%	15.4%	0.007
Diuretics	51%	48.1%	58.9%	0.31
Inotropics	30%	24.1%	48.7%	0.006
ACEI	46%	48.1%	38.4%	0.38
Calcium channel blockers	17%	18.8%	10.2%	0.31
Anticoagulant agent	39%	42.1%	28.2%	0.17
Antiarrhythmic drugs	29%	28.6%	30.7%	0.95

ASA- acetylsalicylic acid; ACEI- angiotesin-converting enzyme inhibitors.

The clinical profile of the patients in this study was similar to those of other studies [14,15]. The duration of precordial pain is an important fact and has clinical implications. In our study, the mean time of pain was greater than 10 hours from the onset of the symptoms to the first assessment in the emergency room. This is probably because our hospital is a referral center in the countryside area of São Paulo State and receives patients from several regions of São Paulo and from other states. Therefore, this reflects characteristics both from our service and from the patients we see. An immediate result of this phenomenon was the relatively low percentage of patients who underwent reperfusion therapy (39%), which is similar to results reported in other studies [13,16]. In an analysis of 2,409 patients, in which 30% fulfilled the criteria for reperfusion therapy, only 72% of them received this treatment [16]. These studies suggest that although this treatment is undoubtedly beneficial [17], many factors exist turning it of difficult access for acute myocardial infarction patients. This fact results in lower adherence to the treatment compared to international recommendations for the administration of reperfusion therapy after acute myocardial infarction [18].

We considered the following traditional risk factors as risk factors for atherosclerotic coronary disease: hypertension, smoking, dyslipidemia (increased serum levels of low density lipoproteins, decreased serum levels of high density lipoproteins), male gender, and diabetes mellitus. However, in recent years, other risk factors have been identified, for

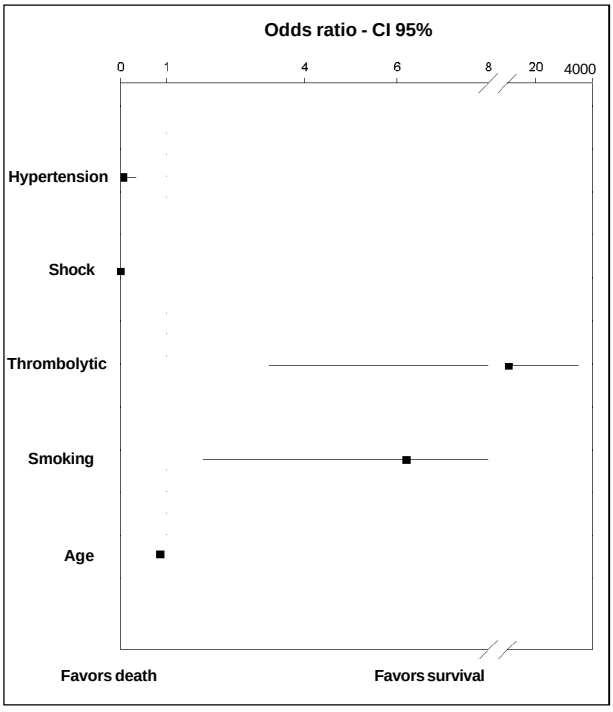

Fig. 1 - Predictors of 30-day mortality in patients after acute myocardial infarction. CI - confidence interval.

example lack of exercise, obesity, fibrinogen alterations, and other serum lipids alterations, and genetic factors[19]. The participation of these factors in atherosclerosis has been increasingly valued: only 6.3% of our patients did not have at least one traditional risk for atherosclerotic disease.

Our study confirmed that, the absence of reperfusion therapy, presence of hypertension, cardiogenic shock, and advanced age are independent factors associated with greater mortality, in 30 days, in patients with acute myocardial infarction. A paradoxical association was verified between history of smoking and lower mortality after infarction. Although smoking is a recognized risk factor for atherosclerotic disease, regarding acute myocardial infarction, infarction smoking patients are, on average, 10 years younger than nonsmoking patients, therefore, having fewer risk factors such as ventricular dysfunction[20]. This fact could explain the occurrence of lower mortality in smokers compared to nonsmokers in our study, because many variables was not included in our multivariable analysis.

Our study showed that beta-blocking agents are still underused, despite the evidences of its beneficial use after myocardial infarction, even in the presence of ventricular dysfunction [9,21,22]. These data are in accordance with that of previous studies [11,13,14], suggesting the presence of some resistance by the physicians with this class of drugs.

Regarding angiotensin-converting enzyme inhibitors, although clinical studies confirm unquestionable benefits when administered in patients with ventricular dysfunction[23,24], favorable evidences exists of its use in all patients after acute myocardial infarction[25,26]. In our analysis, 46% of the patients received this drug during their hospital stay in the intensive care unit.

On the other hand, medications usually prescribed to treat congestive heart failure after acute myocardial infarction (nitrates, angiotensin-converting enzyme inhibitors, diuretics, and inotropic drugs) were used in a large number of our patients. This fact may be a consequence of the characteristics of our intensive care unit. Due to the small number of rooms, patients whose risk stratification indicates a high probability of complications, after acute myocardial infarction, are admitted to the intensive care unit. Thus, our patients had more severe clinical conditions than usual, requiring some particularities concerning the treatment. This would also explain the high mortality (22%) rate observed in our study in the 30-day period after acute myocardial infarction.

Some factors should be considered when interpreting our results. First, our study includes only patients enrolled between 1992 and 1997. In this period, many of the important clinical trials and international recommendations on the treatment of acute myocardial infarction had not been published. Another important point is the fact that we studied only the treatment performed during the stay in the intensive care unit, and we did not study the treatment performed during the period in the hospital or the ambulatory treatment.

In conclusion, our study confirmed that the absence of reperfusion therapy, presence of smoking, hypertension, cardiogenic shock, and advanced age are predictors for 30-day mortality in patients with acute myocardial infarction. Additionally, our results showed that some medications, which have been proved to be beneficial, are still underused after myocardial infarction, confirming a distortion between randomized studies and international recommendations and clinical practice, including an academic medical center hospital. The reasons for this phenomenon are still unknown, but our results highlight the need of discussing and of disclosing the issue to obtain greater adherence to the internationally recommended conduct.

References

1. Tunstall-Pedoe H, Kuulasmaa K, Amouyel P, Arveiler D, Rajakangas AM, Pajak A. Myocardial infarction and coronary deaths in the World Health Organisation MONICA project: registration procedures, event rates, and case-fatality rates in 38 populations from 21 countries in four continents. Circulation 1994; 90: 583-612.
2. Rosamond W, Chambless LE, Folson AR, 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; 861-7.
3. The Multicenter Postinfarction Research Group. Risk stratification and survival after myocardial infarction. N Engl J Med 1983; 309: 331-6.
4. Lee KL, Woodlief LH, Topol EJ, et al. Predictors of 30-day mortality in the era of reperfusion for acute myocardial infarction. Results from an international trial of 41,021 patients. GUSTO-I Investigators. Circulation 1995; 91: 1659-68.
5. Mahon NC, O'Rorke C, Codd MB, McCann HA, McGarry K, Sugrue DD. Hospital mortality of acute myocardial infarction in the thrombolitic era. Heart 1999; 81: 478-82.
6. ISIS-2 (Second International Study of Infarct Survival) Collaboration Group. Randomized trial of intravenous streptokinase, oral aspirin, both, or neither among 17,187 cases of acute myocardial infarction. Lancet 1988; II: 349-60.
7. GISSI (Gruppo Italiano per lo studio della Streptokinasi nell'Infarto Miocardico). Effectiveness of intravenous thrombolytic treatment in acute myocardial infarction. Lancet 1986; I: 397-401.
8. ACE inhibitor myocardial infarction collaborative group. Indications for ACE inhibitors in the early treatment of acute myocardial infarction: systematic overview of individual data from 100,000 patients in randomized trials. Circulation 1998; 97: 2202-12.
9. Yusuf S, Peto R, Lewis J, Collins R, Sleight P. Beta blockade during and after myocardial infarction: an overview of the randomized trials. Prog Cardiovasc Dis 1985; 27: 335-71.
10. Augusti A, Amau JM, Laporte J-R. Clinical trials versus clinical practice in the secondary prevention of myocardial infarction. Eur J Clin Pharmacol 1994; 46: 95-9.
11. Ergin A, Abaci A, Sakalli A, et al. Pharmacological profile of survivors of acute myocardial infarction at Turkish academic hospitals. Int J Cardiol 1999; 68: 309-16.
12. Barron HV, Michaels AD, Maynard C, Every NR. Use of angiotensin-converting enzyme inhibitors at discharge in patients with acute myocardial infarction in the United States: data from the National Registry of Myocardial Infarction 2. J Am Coll Cardiol 1998; 32: 360-7.
13. Rosamond W, Broda G, Kawalec E, et al. Comparison of medical care and survival of hospitalized patients with acute myocardial infarction in Poland and United States. Am J Cardiol 1999; 83: 1180-5.

14. Van de Werf F, Topol EJ, Lee KL, et al. Variations in patient management and outcomes for acute myocardial infarction in the United States and other countries. JAMA 1995; 273: 1586-91.
15. Passos LCS, Lopes AA, Esteves FP, Santos FMO. Diferença de letalidade hospitalar do infarto agudo do miocárdio entre homens e mulheres submetidos a angioplastia primária. Arq Bras Cardiol 1998; 71: 587-90.
16. McLaughlin TJ, Soumerai SB, Willison DJ, et al. Adherence to National Guidelines for drug treatment of suspected acute myocardial infarction. Arch Intern Med 1996; 156: 799-805.
17. Solomon A, Gersh B. The open-artery hypothesis. Ann Rev Medicine 1998; 49: 63-76.
18. 1999 Update: ACC/AHA guidelines for the management of patients with acute myocardial infarction: executive summary and recommendations. A report of the American College of Cardiology/American Heart Association Task Force on practice guidelines (Committee on Management of Acute Myocardial Infarction). Circulation 1999; 100: 1016-30.
19. Armaganijan D, Batlouni M. Impacto dos fatores de risco tradicionais. Rev Soc Cardiol Estado de São Paulo 2000; 10: 686-93.
20. Ottesen MM, Jorgensen S, Kjoller E, Videbaeck J, Kober L, Torp-Pedersen C. Age-distribution, risk factors and mortality in smokers and non-smokers with acute myocardial infarction: a review. J Cardiovasc Risk 1999; 6: 307-9.
21. CIBIS-II Investigators and Committees. The Cardiac Insufficiency Bisoprolol Study-II (CIBIS-II): a randomized trial. Lancet 1999: 353: 9-13.
22. Bristow MR. Beta-adrenergic blockade in chronic heart failure. Circulation 2000; 101: 558-69.
23. Pfeffer MA, Braunwald E, Moye LA, et al. Effect of captopril on mortality and morbidity in patients with left ventricular dysfunction after acute myocardial infarction: results of the survival and ventricular enlargement trial. The SAVE Investigators. N Engl J Med 1992; 327: 669-77.
24. The Acute Infarction Ramipril Efficacy (AIRE) Study Investigators. Effect of ramipril on mortality and morbidity of survivors of acute myocardial infarction with clinical evidence of heart failure. Lancet 1993; 342: 821-8.
25. GISSI-III: effects of lisinopril and transdermal glyceril trinitrate simply and together in 6 week mortality and ventricular function after acute myocardial infarction. Gruppo Italiano per lo Studio della Supravivenza nell'Infarto Myocardico. Lancet 1994: 343: 1115-22.
26. ISIS-4: a randomised factorial trial assessing early oral captopril, oral mononitrate and intravenous magnesium sulphate in 58,050 patients with suspected acute myocardial infarction. Lancet 1995; 345: 669-85.