Original Article

Mortality Decline after Implementation of Standard Protocols for Treating Patients with Acute Myocardial Infarction

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Objective

To compare 30-day mortality in patients receiving different types of medication from 1992 to 1997, when no consensual treatment for acute myocardial infarction was available, versus 30-day mortality in patients being treated between 2000 and 2002 after standardization of that treatment was obtained in our service.

Methods

In the first and second study periods, 172 and 143 patients, respectively, admitted with the diagnosis of acute myocardial infarction were retrospectively assessed. Their diagnoses were confirmed, and the following statistical tests were performed: the chi-square test for comparing proportions and the Student t test and the Mann-Whitney test for comparing the means or medians.

Results

The analysis showed no difference in regard to white men with a mean age of 61 years in the 2 study periods. In regard to the traditional risk factors, a difference was observed only in the incidence of dyslipidemia (17 and 29%). In regard to the therapeutic strategy adopted, the following was observed: 1) a significant increase in the use of thrombolytic agents (39 and 61.5%), acetylsalicylic acid (70.9 and 96.5%), beta-blockers (34.8 and 67.8%), angiotensin-converting enzyme inhibitors (45.9 and 74.8%), and nitrates (61 and 85.3%); and 2) a significant reduction in the use of calcium channel blockers (16.8 and 5.3%), antiarrhythmics (29.1 and 9.7%), and diuretics (50.6 and 26.6%). The use of inotropic agents did not differ between the study periods (29.6 and 32.1%). The 30-day mortality showed a statistically significant reduction from 22.7 to 10.5%.

Conclusion

The implementation of standard protocols for the treatment of acute myocardial infarction was accompanied by a significant reduction in the 30-day mortality rate.

Key words

myocardial infarction, mortality, treatment

Heart diseases, among which coronary artery disease stands out, are one of the major causes of morbidity and mortality in most countries. In addition to the great financial burden imposed on the health care system, patients with acute myocardial infarction have a substantially high risk of evolving with some complications, such as a second cardiovascular event or congestive heart failure [1,2].

The control of cardiovascular risk factors is fundamental to reduce the prevalence of acute myocardial infarction. Currently, the risk factors are classified as noncontrollable, such as aging and inheritance, and controllable, such as smoking, hypercholesterolemia, arterial hypertension, physical inactivity, obesity, and diabetes mellitus.

It is worth stressing that the outcome of a patient with acute myocardial infarction results from the interaction of the clinical characteristics of his/her cardiac event and certain prognostic factors that can be properly assessed so that his/her risk may be accurately estimated [3,4]. The recognition of the major risk factors for the coronary event as well as of the factors responsible for early mortality may be determinant for the therapeutic intervention and other clinical resources applied to patients with infarction.

Despite the advances in the treatment of acute myocardial infarction, the mortality indices remain substantially elevated [5,6]. Some studies indicate that this may be due to the fact that many patients with acute myocardial infarction may not be receiving the entire treatment recommended, suggesting a dissociation between the large clinical studies and clinical practice [7-10]. In addition, the impact on clinical practice of the treatments recommended has not been sufficiently studied.

This study aimed at comparing the clinical profile, the major groups of medications, and 30-day mortality in a tertiary university-affiliated hospital of inner São Paulo state in the following 2 periods: 1) from 1992 to 1997, when no treatment protocol was available for patients with acute myocardial infarction; and 2) from 2000 to 2002, after standardization of the treatment for those patients.

Methods

The medical records of the patients admitted to the intensive care unit (ICU) at our institution were retrospectively assessed in the following 2 time periods: 1) from January 1992 to December 1997, when no treatment protocol was available for patients with acute myocardial infarction; 2) from March 2000 to August 2002,

after standardization of a treatment protocol for those patients. The information collected concerned both the period when the patients remained in the clinical emergency room (CER) and the period spent in the ICU. In the first and second periods, the assessment comprised respectively 172 and 143 patients admitted with a diagnosis of acute myocardial infarction. Their diagnoses were confirmed by combinations of precordial pain or electrocardiographic changes, or both, and elevation of the serum levels of the cardiac enzymes.

In regard to the clinical profile, data were obtained from anamnesis and physical examination on hospital admission. The variables assessed were as follows: age, sex, race, heart rate, systemic blood pressure, electrocardiographic location of the infarction, and duration of precordial pain, from symptom onset to the moment of the first assessment in the emergency room.

The following risk factors were assessed: familial history, smoking, arterial hypertension, diabetes mellitus, and dyslipidemia, which are variables classified as traditional risk factors. A positive familial history included first-degree relatives, up to 2 previous generations. Smokers were those patients who used to smoke daily, regardless of the number of cigarettes smoked. Diabetic patients were those who, in previous examinations or during admission, had fasting glycemia levels compatible with the diagnosis. Hypertensive patients were those diagnosed as such prior to acute myocardial infarction. Dyslipidemia was determined by the presence of elevated serum levels of low-density lipoproteins or low serum levels of high-density lipoproteins. Obesity was not included, due to the lack of reference to this variable in the medical records.

The classes of medications analyzed were as follows: thrombolytics, acetylsalicylic acid, angiotensin-converting enzyme inhibitors, beta-blockers, calcium channel blockers, antiarrhythmics, nitrates, inotropic agents, and diuretics, assessed in regard to their percentage use and considering drugs used for at least 48 hours.

Weekly meetings with the staff of the clinical emergency room and the intensive care unit were held for developing the protocol. For implementation of the protocol, restructuring of the emergency department was required so that patients with chest pain could be quickly referred to the clinical emergency room, which was designed for providing rapid patient evaluation with collection of samples for examination and immediate electrocardiographic performance.

The proportional variables were assessed using the chi-square test, and the continuous variables were tested for normality; the mean values and the standard deviations were calculated for the groups studied. In the case of normal distribution, the Student t test was used for comparing the variables. For the nonparametric variables, the values of the median and the interquartile intervals of the groups studied were calculated. The Mann-Whitney test was used to compare the groups. The SigmaStat statistical package for Windows v 2.0 of the Jandel Co (San Rafael, CA, USA) was used for these tests. The significance level adopted was 5% for all tests.

Results

Table I shows the clinical characteristics of the patients at the moment of the diagnosis of acute myocardial infarction. No statistically significant differences were found between the patients with acute myocardial infarction in the 2 study periods. White men with a mean age greater than 60 years prevailed. In the 2 time periods, the median duration of precordial pain from symptom onset to the first evaluation at the emergency room was relatively great: 4 (2.3-11 h) in the 1992-1997 period, and 5 (2.1-12 h) in the 2000-2002 period.

Table II shows the incidence of the traditional risk factors for coronary artery disease in the 2 study periods. Of the risk factors analyzed, arterial hypertension was the most prevalent in the 2 periods (63% in the 1992-1997 period, and 66% in the 2000-2002 period). In addition, most patients studied had at least one classical risk factor (93.7% in the 1993-1997 period, and 95.8% in the 2000-2002 period).

Table III shows the treatment administered to the patients during their stay at the ICU. A significant change was observed in the therapeutic management of patients with acute myocardial infarction. Considering the 1992-1997 and 2000-2002 periods,

Table I - Characteristics of the patients with acute myocardial infarction			
	1992-1997 Period (n=172)	2000-2002 Period (n=143)	Significance
Age	61.2 ± 11.6	61.5 ± 5.6	p = 0.81
Male sex	66.3%	70.6%	p = 0.48
White sex	96.9%	94.4%	p = 0.45
Duration of pain (hours)	4 (2.3-11)	5 (2,1-12)	p = 0.55
MBP (mm Hg)	97 (83-107)	93 (83-113)	p = 0.73
HR (bpm)	80 (68-95)	77 (68-90)	p = 0.19
Location of AMI			p = 0.85
Anterior	40.0%	43.4%	
Inferior	39.2%	37.8%	
Other	18.7%	18.8%	

MBP - mean blood pressure; HR - heart rate.

Table II - Traditional risk factors for coronary heart disease			
	1992-1997 Period (n = 172)	2000-2002 Period (n = 143)	Significance
Smoking	55.8%	65.7%	p = 0.09
Diabetes Mellitus	26.1%	32.2%	p = 0.30
Arterial hypertension	63.6%	65.7%	p = 0.78
Familial antecedents	19.2%	14.0%	p = 0.28
Dyslipidemias	16.9%	28.6%	p = 0.02

Table III - Thirty-day mortality and treatment for patients with acute myocardial infarction hospitalized at the intensive care unit			
	1992-1997 Period (n=172)	2000-2002 Period (n=143)	Significance
Thrombolytics	39.0%	61.5%	p < 0.001
ASA	70.9%	96.5%	p < 0.001
Beta-blocker	34.9%	67.8%	p < 0.001
ACEI	45.9%	74.8%	p < 0.001
Diuretics	51%	27%	P < 0.001
Inotropic agents	30%	32%	P = 0.719
Nitrates	61%	85%	P < 0.001
Calcium blockers	17%	5%	P = 0.007
Antiarrhythmics	29%	10%	P < 0.001
Mortality	22.7%	10.5%	P < 0.001

ASA - acetylsalicylic acid; ACEI - angiotensin-converting anzyme inhibitors.

375

an increase in the percentage use of the following medications occurred: acetylsalicylic acid (71 x 97%); thrombolytic agents (39 x 62%); angiotensin-converting enzyme inhibitors (46 x 75%); beta-blockers (35 x 68%); and nitrates (61 x 85%). On the other hand, diuretics (51 x 27%) and antiarrhythmics (29 x 10%) were used less from the 1992-1997 period to the 2000-2002 period. The use of inotropic agents did not differ in the 2 study periods (30 x 32%).

The 30-day mortality of patients with acute myocardial infarction in the 2000-2002 period showed a statistically significant reduction (10.5% vs 22.7%; P<0.001; reduction of 53%) as compared with that in the 1992-1997 period (tab. III).

Discussion

The objective of this study was to assess the impact on mortality of measures recommended by national and international associations for the treatment of patients with acute myocardial infarction. Our results show that adherence to the treatment protocol of patients is associated with a 53% reduction in 30-day mortality.

The clinical profile reported by other authors who studied patients from large centers [5,6,11,12] was similar to that evidenced by the present study with a sample originating predominantly from the inner regions of the State of São Paulo. The fact that more than 90% of the patients had at least 1 traditional risk factor facilitates the identification of patients at risk and stresses the importance of adopting preventive measures against the risk factors for coronary artery disease. A fundamental aspect of our study is that changes in the characteristics of the patients could explain the reduction in mortality observed from the 1992-1997 period to the 2000-2002 period. Comparing the 2 time periods, however, no change in the clinical profile of patients with acute myocardial infarction was identified. Another point worth noting in our case series is that the median duration of precordial pain was relatively long (> 4 h) in both periods. This may be explained by the fact that our service is a tertiary referral center for a large region of inner São Paulo state, and that it lacks a program of community education regarding the need for searching medical care as soon as the symptoms of coronary heart disease appear. Similarly, the characteristics of the patients and the risk factors of coronary heart disease did not significantly differ in the 2 time periods. The only difference observed was an increase in the incidence of dyslipidemia in the 2000-2002 period as compared with that in the 1992-1997 period. Therefore, one may infer that changes in the clinical profile do not justify the reduction in mortality between the different study periods.

In recent years, a variety of medications have been introduced for managing myocardial infarction [13,14]. Currently, no reason exists for questioning the beneficial effects of beta-blockers for patients with acute myocardial infarction, because evidence is available that this class of medication may reduce the size of the ischemic lesion, attenuate the process of ventricular remodeling, decrease the frequency of aneurysm formation, reduce the number of ventricular ruptures, and decrease mortality even in situations of ventricular dysfunction [15,16]. In regard to the angiotensin-converting enzyme inhibitors, although the great clinical trials have shown an unequivocal benefit only when those drugs are used in patients with ventricular function changes, evidence exists favoring their use in all patients after acute myocardial infarction [17,18]. Similarly, thrombolytic therapy and acetylsalicylic acid have also been associated with an irrefutable reduction in mortality [19,20]. Several reports, however, have suggested the existence of low adherence to these recommendations [7-10, 21-23]. One of the most important aspects of this discussion is that the phenomenon of nonadherence to the recommended treatment seems not to be restricted to patients with acute myocardial infarction, but may also be identified in other important diseases, such as congestive heart failure [24,25] and infarction with no elevation of the ST segment [26].

In our service, we introduced a protocol for managing patients with acute myocardial infarction at the end of the 1990s. According to this protocol, the patient with the following 2 findings was eligible for reperfusion therapy: typical precordial pain lasting more than 20 minutes but less than 12 hours in association with electrocardiographic alterations compatible with acute myocardial infarction according to the international recommendations [11]. If no contraindications were identified, all patients should receive acetylsalicylic acid and beta-blockers on a routine basis. Two to 4 hours after the administration of the beta-blocker, the patients received the angiotensin-converting enzyme inhibitors in progressive doses until the full dose was reached. For patients with precordialgia, pulmonary congestion, and occasional arterial hypertension, intravenous nitroglycerin was indicated. Calcium channel blockers were indicated only in cases of arterial hypertension or angina refractory to standard treatment.

Our results show that, after the implantation of the standardized protocol for the treatment of patients with acute myocardial infarction, a significant increase was observed in the use of the medications that confirmedly improved the prognosis after acute myocardial infarction (reperfusion therapy, acetylsalicylic acid, beta-blockers, and angiotensin-converting enzyme inhibitors). Not surprisingly, the use of these medications was associated with a significant reduction in 30-day mortality. The high percentage use of nitrates in the 2 study periods was noteworthy to some extent, and this fact may be due to the characteristics of our service. As a tertiary hospital, we receive more critically ill patients with varied degrees of ventricular dysfunction and recurring ischemia, which require some particularities in regard to treatment.

It is worth emphasizing that the same phenomenon observed in our case series was observed in other studies. In the multicenter GRACE study [27], a significant difference occurred in the treatment of patients with infarction depending on the characteristics of the hospital and the geographical location. Despite these differences, however, the use of acetylsalicylic acid (91%) and beta-blockers (81%) was widespread. This phenomenon was accompanied by a low in-hospital mortality rate (7%). In a study carried out in the municipality of Rio de Janeiro [28], the use of acetylsalicylic acid, beta-blockers, and angiotensin-converting enzyme inhibitors was also associated with a lower risk of death. In the GAP initiative [29], the implementation of a program to improve the quality of medical care to patients with acute myocardial infarction resulted in greater adherence to the use of acetylsalicylic acid and beta-blockers during hospitalization. In addition, a significant increase in the number of patients quitting smoking after hospital discharge occurred. Similarly, in patients with congestive heart failure, the implementation of a training program to the team responsible for patient care in

conjunction with the adoption of a treatment protocol resulted in greater adherence to the recommendations, shorter hospital stay, and lower costs [30].

In conclusion, our study stresses that, even at tertiary univer-sity-affiliated hospitals, the introduction of protocols increased adherence to the national and international recommendations for the treatment of patients with acute myocardial infarction with a consequent reduction in mortality.

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377