Acute Myocardial Infarction in Elderly Patients. Comparative Analysis of the Predictors of Mortality. The Elderly Versus the Young

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Objective *- To study the in-hospital evolution of patients aged 65 years and older, with acute myocardial infarction, who were treated by direct coronary angioplasty with no fibrinolytic therapy.*

Methods *- We studied 885 patients divided into 2 groups as follows: group I (GI) - 293 (33.4%) patients aged ≥ 65 years (72±5 years), and group II (GII) - 592 patients aged < 65 years (57±9 years). Multivessel disease was more frequent in GI (63.5% x 49.7%; p=0.001). A greater number of GII patients were class I or II of the clinical Killip-Kimball classification (K) (80.2% x 67.2%; p=0.00002), while a significant number of GI patients were KIII and KIV (24.3% x 12.8%; p=0.00003).*

Results *- Group I had a lower index of success (84.6% x 94%; p=0.0002) and a greater in-hospital mortality (12.2% x 4.7%; p=0.00007). The predictors of mortality in GI were as follows: previous infarction (20.5% x 6.3%; p=0.02), anterior location (13.4% x 6.4%; p=0.03), and male sex (10.4% x 4.4%; p=0.007).*

Conclusion *- Elderly patients had more severe acute myocardial infarction and more extensive disease, a lower index of success, and greater in-hospital mortality. Previous infarction, anterior location and male sex were identified as predictors of mortality in the elderly group (GI).*

Key words: acute myocardial infarction, coronary angioplasty, the elderly

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In the coming decades, as has been occurring in developed countries, Brazil will experience the process of population aging. The intensity of this process is expected to place Brazil's population as the 6th most elderly in absolute numbers within the first 25 years of this millennium. Life expectancy in Brazil increased from 43 years in 1950 to 65 years in 1991 [1]. It has been projected to reach 72 years in 2020. Because of the large extension and diversity of the country leading to regional differences, this process will not occur in an even manner, being more marked in the southern and southeastern regions than in the northern and northeastern regions [2]. In the southern region, where the sample of this study was collected, and according to the statistics of 1993, life expectancy is 68.6 years, which is 3 years greater than the life expectancy of the general Brazilian population [1].

As people age, a trend towards a change in the pattern of morbidity and mortality occurs. At the beginning of the 20th century, the major cause of death in Brazil was infectious disease, which has been replaced currently by cardiovascular causes. Of all chronic diseases, cardiovascular diseases account for the greatest number of hospitalizations in Brazil [3], and they appear as the cause of death in almost half of the records in the Brazilian capitals in the southern and southeastern regions [2].

Compared with the general population, the elderly have a greater number of diseases, mainly chronic, and a high prevalence of coronary artery diseases [3]. Approximately 70% of the individuals above 70 years of age have coronary artery disease, which is the major cause of morbidity and mortality in that age group. Acute myocardial infarction and sudden death are frequent initial manifestations of coronary artery disease in the elderly; therefore, early diagnosis is paramount to prevent these complications, and the peculiarities inherent to each age group must be known [4]. These factors cause the prevalence of the disease diagnosed during life to be less than half of the cases of significantly obstructive atherosclerotic disease found at autopsies [5].

Initially reported by Hartzler [6], coronary angioplasty for treating acute myocardial infarction was performed in patients who were or were not using thrombolytic agents prior to the procedure. Direct coronary angioplasty without the previous use of thrombolytic agents has been routinely performed at our service since 1982, and technical and pharmacological resources resulting from different studies have been incorporated throughout these years. Among those resources, we highlight the use of coronary stents that optimize the results, especially the incidence of recurring ischemia and late restenosis [7], and the use of antithrombotic agents.

The objective of this study was to compare the in-hospital evolution of patients aged > 65 years with that of patients < 65 years, who were hospitalized within the first 24 hours after acute myocardial infarction and were treated with mechanical reperfusion followed by direct coronary angioplasty with no previous antithrombotic therapy.

Methods

We carried out a retrospective study of consecutive procedures of mechanical recanalization followed by direct coronary angioplasty for myocardial reperfusion as a treatment for acute myocardial infarction within the first 24 hours of its presentation, with no pharmacological reperfusion, then defined as primary angioplasty.

The study comprised a total of 861 patients undergoing 885 direct coronary angioplasty procedures divided into 2 groups as follows: group I (GI), comprising 288 patients aged ≥ 65 years (72±5 years) and undergoing 293 (33.1%) procedures; and group II (GII), comprising 573 patients aged < 65 years (57±9 years) and undergoing 592 (66.9%) procedures.

The diagnosis of acute myocardial infarction was confirmed by clinical, electrocardiographic, and hemodynamic findings. The patients studied were admitted consecutively. The following characteristics were not considered criteria for exclusion: cardiac arrest as a presentation of acute myocardial infarction (sudden death), cardiogenic shock, bradyarrhythmias or tachyarrhythmias, multivessel lesions, impairment of the left coronary trunk, previous myocardial infarction, and previous myocardial revascularization.

All patients were classified according to the Killip–Kimbal classification [8,9], but a group of patients could not undergo that classification because they were experiencing cardiac arrest or shock associated with complete atrioventricular block or ventricular tachycardia. This group was called nonclassified. All patients received nitrates, sedatives, analgesics, 10,000 units of intravenous heparin and acetylsalicylic acid. Once the patient or his guardian provided the formal written consent, diagnostic cardiac catheterization and interventional therapy were performed. Direct coronary angioplasty was performed after mechanical recanalization with a 0.014" guidewire when the vessel responsible for the acute myocardial infarction was totally occluded (TIMI 0) or directly upon the lesion (TIMI I, II, and III) [10]. Balloon and coronary stents were used for direct coronary angioplasty. Antiarrhythmic, vasopressor, and vasodilator drugs, beta-blockers and abciximab, invasive continuous hemodynamic monitoring, transitory pacemaker, and the use of intra-aortic balloon followed specific and individualized indications. After the procedure, all patients were referred to the coronary care unit for electrocardiographic, blood pressure, and hemodynamic monitoring.

Success on reperfusion (direct coronary angioplasty) was defined as the presence of TIMI II and III degree of flow after coronary angioplasty, and luminal diameter > 50% in the absence of major complications, such as death, emergency surgery, and occlusion after the procedure.

Data were stored and analyzed with Epi Info software, version 6.0, which through the TABLES command produces contingency tables to test the associations between 2 factors. The software calculates the relative risk and its statistical significance (through the 95% confidence interval) using the following formula: RR=(a/H1)(c/H2), based on values of the contingency table. Chi-square values were calculated with the Yates correction, in which "p" values were given for a degree of freedom. When 1 of the values of the contingency table was < 5, we used the corrected Fisher exact test (2-tailed).

SPSS software, version 8.0, was used for the actuarial curve of survival and the Kaplan-Meier method for accumulated risks.

The Student *t* test, chi-square test, Fisher exact test, median test, and Kruskal-Wallis test were applied for independent samples, and the binomial distribution for the case of a single sample. The statistical significance level adopted was 5.0% ($p<0.05$).

Results

Of the total sample of 885 procedures, 288 patients (293 procedures) were 65 years of age or older (GI), and 573 patients (592 procedures) were less than 65 years (GII).

Of the GI patients, 177 (61.4%) were males and 111 (38.4%) were females, with a mean age of 72±5.3 years, and, of the GII patients, 435 (79.1%) were males and 120 were females (20.9%) with a mean age of 57±9 years. A progressive increase in the frequency of the female sex in more advanced age brackets was observed, and from 65 years of age on this difference was less significant, with a predominance of females after the age of 80 years (fig. 1).

Previous infarction was present in 39 (13.3%) GI patients and in 95 (16%) GII patients (p=0.3). Nineteen GI patients (6.5%) and 28 (4.7%) GII patients had a previous myocardial revascularization surgery (p=0.3).

Examining the risk factors for coronary artery disease (systemic arterial hypertension; diabetes mellitus; familial history of coronary artery disease; dyslipidemias; obesity; and smoking), smoking was not only the most frequently found but also had a high significance in GII (patients < 65 years) (42% x 22.8%; p= 0.0000001).

A greater number of GII patients were in classes I or II of the Killip-Kimball clinical classification (K) (80.2% x 67.2%; p=0.00002), while KIII and IV significantly predominated in GI (24.3% x 12.8%; p=0.00003). Twenty-five patients were considered nonclassified (NC) (tab. I).

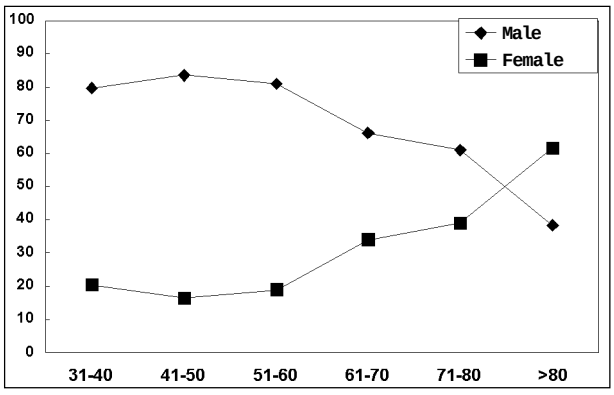

Fig. 1 - Percentage values of the incidence of sex and age group in a 10-year period.

The location of acute myocardial infarction was similar, with no significant differences between the 2 groups: anterior wall (45.1% x 41.6%), inferior wall (41.6% x 41%), and lateral wall (15.1% x 13.9%), for GI and GII, respectively.

The mean duration of reperfusion was 327±234 minutes for GI patients (the elderly) and 305±225 minutes for GII patients (< 65 years).

No difference regarding the degree of flow was observed between the groups (tab. II).

Multivessel disease, defined as atherosclerotic disease obstructing more than 70% of the lumen of more than 1 major coronary artery or their branches, or both, found on coronary angiography was more frequent and significant in GI: 186 patients (63.5% x 49.7%; p = 0.001).

Success was obtained in 797 (90.05%) procedures and was significantly greater in GII, 549 (94.0%), than in GI, 248 (84.6%) (p=0.0002).

The 7.2% in-hospital mortality when analyzed for both groups was significantly greater in GI, 36 (12.2%) patients, as compared with 28 (4.7%) patients in GII (p= 0.00007). This represented a relative risk of death in patients > 65 years (GI) of 2.6 per procedure.

The mean age of the GI patients (age ≥ 65 years) who died was 75±6 years, significantly greater than the mean age of those who survived (71±5 years) (p=0.002).

Table I - Killip-Kimbal classification of the patients with acute myocardial infarction [8,9]

Killip-Kimbal	GI	GII	p
I/II	197 (67.2%)	475 (80.2%)	0.00002
III/IV	71 (24.3%)	76 (12.8%)	0.00003
Nonclassified	25 (8.5%)	41 (7%)	NS
Total	293	592	

Table II - Coronary flow degree according to TIMI [10]

TIMI	GI	GII	P
0	226 (77.1%)	450 (76%)	NS
I	37 (12.6%)	78 (13.2%)	NS
II	19 (6.5%)	48 (8.1%)	NS
III	11 (3.7%)	16 (2.7%)	NS

Smoking, the only risk factor for coronary artery disease significantly more frequent among GII patients (p=0.0000001), showed no significance when correlated with mortality (18% GI x 28% GII; p=0.08).

In-hospital reocclusion was 8.8% for the patients > 65 years and 4.4% for those < 65 years, but no significance between the 2 groups was observed (p=0.11).

The following findings were identified as predictors of in-hospital mortality: presence of previous infarction, infarction of the anterior wall, and the male sex (tab. III).

The KIII and KIV functional classes were risk factors for both groups. When analyzing the summation of the KIII, KIV, and NC functional classes, mortality was 30.2% in GI and 20.5% in GII, but no statistically significant difference was observed (p=0.14). The comparison between the groups is shown in figure 2.

Mortality was greater in females (15.4%) as compared with that in males (10.4%) in GI, the same occurring in GII, which had a 6.7% mortality in females as compared with a 4.4% mortality in males, but with no significant difference. When this same analysis was applied to compare the 2 groups (GI x GII), mortality was greater and more significant in GI males (10.4% x 4.4%; p=0.007) but with a borderline significance, among females, showing only a trend (15.4% x 6.7%; p=0.053) (fig. 2, graph 1).

Patients with single-vessel and multivessel disease in GI (≥ 65 years) had a similar mortality (12.1% and 12.4%, single-vessel and multivessel disease, respectively), while in GII patients (< 65 years), mortality was significantly greater for those with multivessel lesions (7.5%) as compared with that of patients with single-vessel disease (1.7%; p=0.0009).

Patients with single-vessel disease in GI had significantly greater mortality than those with single-vessel disease in GII (11.1% x 1.7%; p=0.0004) (fig. 2, graph 2). Patients with multivessel disease in GI had mortality of 12.4% as compared with 7.5% for those in GII, but with no significance (p=0.1).

Analyzing in-hospital reocclusion in regard to mortality in GI and GII groups, we observed that 5 of the 26 procedures occurred in GI (19.2%) and 3 of 26 procedures occurred in GII (11.5%); (p=0.35).

In the late follow-up, after hospital discharge, the mortality rate was 18.8%. The Kaplan-Meier actuarial curve showed 93.5% survival in the 1st year, 91.42% in the 2nd year, and 75% survival in 5 years for the elderly.

Discussion

Some authors have reported that acute myocardial infarction in the elderly deserves special consideration be-

Table III - Predictors of in-hospital mortality

Predictors of mortality	≥ 65 years (GI) %	< 65 years (GII) %	P
Previous infarction	20.5	6.3	0.02
Anterior AMI	13.4	6.4	0.03
Male sex	10.4	4.4	0.007

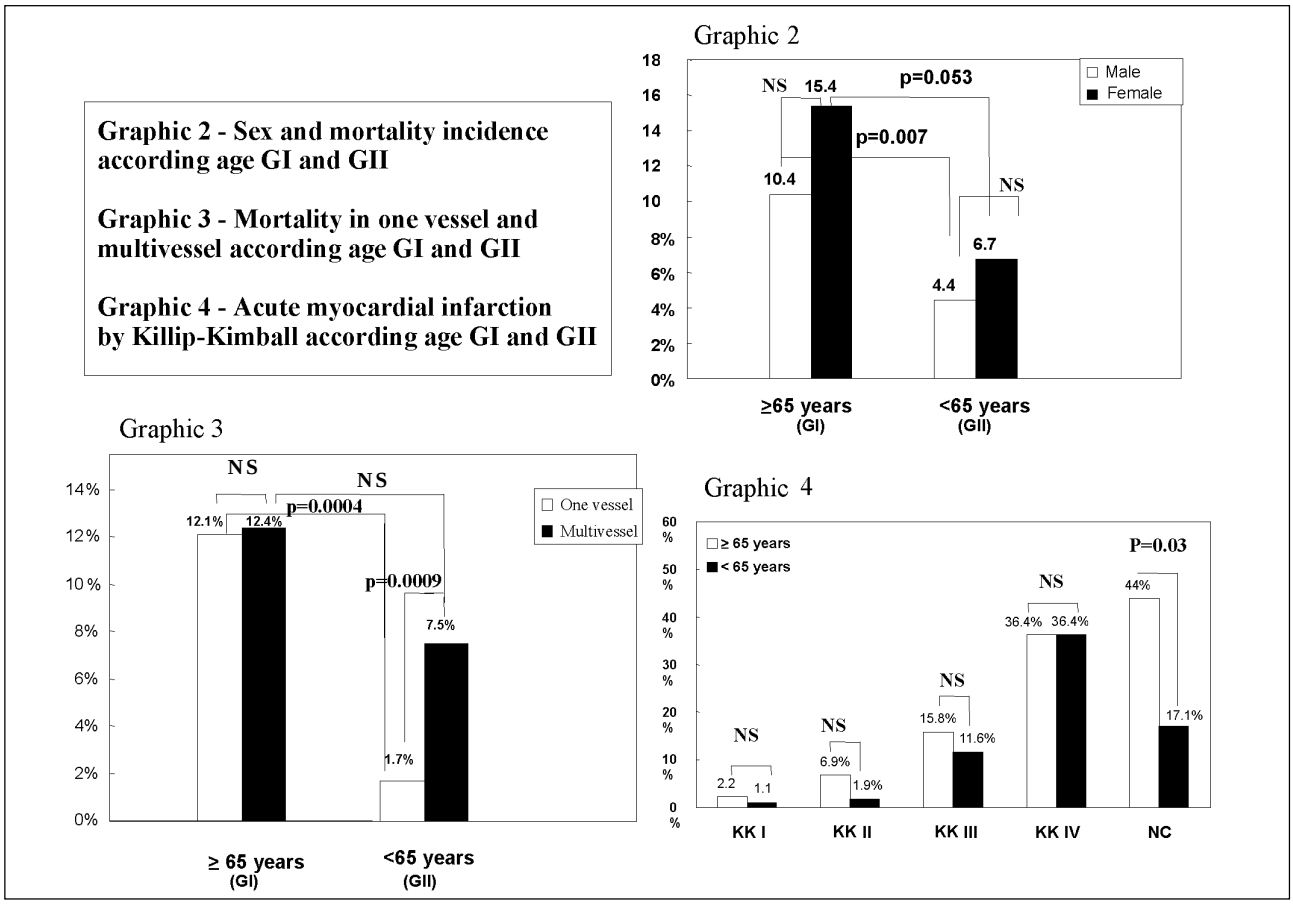

Fig. 2 – Analysis of mortality according to sex, vessels impaired, and Killip-Kimball functional class in patients aged ≥ 65 years (GI) and < 65 years (GII).

cause of high in-hospital morbidity and mortality and the pessimistic prognosis during in-hospital stay [11-13]. Clinical studies have shown in-hospital mortality ranging from 32% to 60% in this age group, and it could reach 93% to 100% in the presence of cardiogenic shock [14]. These findings suggest that the reperfusion methods should be used in that population with confirmed advantages [15].

Direct coronary angioplasty performed in elderly patients (>75 years) was reported as a high-risk procedure due to the greater index of complications. The in-hospital mortality reported is greater in patients in this age group (0.8 to 8.5%) as compared with that in younger patients (0 to 1.8%) [11-14, 16-19]. Hartzler et al [20] reported a 2.6 relative risk for mortality after direct coronary angioplasty in patients > 70 years, and, in this study, we found the same 2.6 relative risk using a cutoff for age of 65 years. It is worth noting that the mean age in GII (patients < 65 years) was 57±9 years, and, in the elderly group (GI), the mean age was 72±5.3 years, indicating that most patients in GII could be very close to the cutoff for age (fig. 3). But because females have acute myocardial infarction 10 years later than males do, this can eventually represent a bias in the cutoff for age between males and females.

This study showed that elderly patients with acute myocardial infarction are admitted to the hospital with more severe clinical findings than those of younger patients. In the elderly, atherosclerotic arterial disease is more extensive with multivessel involvement. Primary direct coronary angioplasty in acute myocardial infarction in the elderly had lower indices of success for reperfusion than those found in the younger patients; nevertheless, the procedure had very positive indices (84.6%) and a low in-hospital mortality (12.2%), which are in accordance with findings of other studies for that age group [21-23].

In-hospital mortality correlated with the clinical presentation, ie, with the Killip-Kimbal functional class, being significantly greater in functional classes III and IV in both groups (fig. 2, graph 3). But when the 2 groups were compared with each other, the differences were not statistically significant, suggesting that the severity of the clinical presentation in acute myocardial infarction could be more important than age at presentation of the acute myocardial infarction.

Direct coronary angioplasty may be used as a method for myocardial reperfusion in patients with cardiogenic shock and lead to a significant reduction in mortality as reported by O´Keefe et al [24]. Their results were the first accepted and clearly defined indication published in the international literature of the use of percutaneous (mechanical) reperfusion in acute myocardial infarction. Considering the patients with cardiogenic shock, the authors observed a 36% mortality, which was lower than that reported in previous clinical studies, and coincided with the results by

Mattos et al [25]. These results were also comparable to those reported by Lee et al [26] in a pioneering study, which spawned the acceptance of primary direct coronary angioplasty in patients with Killip-Kimball functional classes III and IV. These results represented more than isolated numbers, a never published improvement in mortality indices, or even better, in the perspective of survival for patients with acute myocardial infarction and cardiogenic shock (a 50% mortality for patients admitted with cardiogenic shock). This has opened a new and promising path for research in cardiology. Maintaining patency in the artery is fundamental for the survival of these patients.

The anterior wall as the site of the infarction, the presence of previous infarction, and the male sex were identified as predictors of mortality in the group of patients > 65 years. Even though the female sex was more prevalent in the elderly group and had the greatest percentage of in-hospital deaths, these findings did not reach significance, representing only a trend in the statistical analysis (p=0.053). Because females have acute myocardial infarction 10 years later than males do, this may eventually mean a bias in the cutoff for age [27].

Even though smoking was more frequent and significant in GII (22% x 42%; p=0.0000001), it showed no correlation with mortality (p=0.08).

In a recent study, Munhoz and Oliveira [28] reported an unfavorable impact on in-hospital mortality related to in-hospital reocclusion in acute myocardial infarction in patients treated with primary direct coronary angioplasty. In the present study, in-hospital reocclusion was not shown to be a predictor of mortality in the groups. As in-hospital reocclusion is not a frequent phenomenon, a greater number of patients would be required, which would demand an excessively long time for sample collection. Even though that number of patients was sufficient for the analysis of other phenomena, it would probably be lower than the number required to analyze the phenomenon of reocclusion (5 patients in GI and 3 in GII, mortality of 19.2% x 11.5%; p=0.35).

The presence of multivessel lesions with a greater extension of atherosclerotic coronary artery disease and statistical significance (63.5% x 49.7%; p=0.001) in GI was not also identified as a predictor of mortality. This confirmed the previous findings [28] that the extensiveness of the disease, which is a decisive factor in the therapeutical approach to atherosclerotic coronary artery disease and has great prognostic importance in the long run, does not represent an unfavorable impact on the initial approach, the in-hospital phase, of acute myocardial infarction. This also suggests that the approach of the artery responsible for acute myocardial infarction could represent a more significant impact for the patient in this phase, once again suggesting that revascularization of the artery responsible for acute myocardial infarction is more important than complete revascularization in the acute phase of acute myocardial infarction.

Our results for late evolution of global survival in acute myocardial infarction in the 1st year (93.5%), 2nd year (91.4%), and 5th year (75%) following hospital discharge are better than those reported in previous studies, with no therapy for myocardial reperfusion, mortality for which ranged from 28% to 40% in the 1st year and was 47% in the 2nd year [29,30].

The mean age of the GI (age ≥ 65 years) patients dying was 75±6 years, which was significantly greater than the mean age of the surviving patients (71±5 years); (p=0.002). These findings are in accordance with those in previous publications. Advanced age is a risk factor in the evolution of acute myocardial infarction. The TIMI Risk Score for STEMI [31] reports that age > 65 years is the major scoring factor among the predictors of mortality, contributing with an increase from 2.2% to 4.4%; however, we did not use this score in our study.

In conclusion, patients aged ≥ 65 years have more severe acute myocardial infarction and more extensive coronary artery disease. When compared with the younger group, these patients have a lower index of success and higher in-hospital mortality. The presence of previous infarction, the anterior wall as the site of acute myocardial infarction, and the male sex were identified as predictors of death in elderly patients. Our findings both in the in-hospital and late phases suggest that coronary angioplasty may be the therapy of choice and not an exception in elderly patients of both sexes. Further randomized and controlled studies are required to confirm these findings. Being an observational, retrospective, nonrandomized study with no control group may constitute the major limitation for extrapolating the results of our study to other populations.

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