Treatment of a Cohort of Patients with Acute Myocardial Infarction and ST-segment Elevation

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Summary

Background: **Although thrombolysis and primary CTA are well-established procedures, they are not administered in a large proportion of the patients with STEMI who arrive to the emergency rooms.**

Objective: **Describe initial and final the results in a cohort of STEMI patients**

Methods: **The study included, from hospital admission to the discharge, 158 patients diagnosed with STEMI, from a total of 351 patients with ACS admitted to hospitals in Campos dos Goytacazes, RJ, Brazil, between 2004 and 2006.**

Results: **Of the 158 patients with STEMI, 67.7% arrived to the hospital within 180 minutes, 81.3% within 360 minutes, and 8.4% after twelve hours from the symptoms. Cinecoronariographic studies (148) were performed (93,7%). Lesions of over 70% were observed in 266 artery territories. The initial treatment was CTA in 41 (26%), thrombolytics in 50 (32%), 80% of success. Clinical treatment in 67 (42%). Approximately 35% of the patients should have undergone thrombolysis, but they didn´t. During the final treatment, 93 CTAs were performed: 89 with angiographic success (95.7%), bleeding 2 (2.2%), subacute occlusion 2 (2.2%), trunk dissection 1 (1.1%), pseudoaneurism 1 (1.1%). No deaths during angioplasty; during evolution, there were two deaths (2.1%). Twelve patients underwent myocardial revascularization surgery (MRS), while 53 underwent clinical treatment, with 11 deaths (20.7%). Global lethality was 9.5%, considering the three types of treatment.**

Conclusions: **Patients were suitable for reperfusion, but one third of them did not have the procedure. Two deaths during evolution. The most predominant treatment was CTA, with low morbidity. Low global lethality. (Arq Bras Cardiol 2009; 92(6) : 430-436)**

Key words: **Myocardial infarction / mortality; thrombolytic therapy; health profile; evidence – based medicine; lethality.**

Introduction

The cardiovascular diseases (CVD) constitute an important cause of mortality worldwide[1] and the projection for the year 2020 is that 40% of the deaths will be related to CVD. In this context, the acute myocardial infarction (AMI) will be the main isolated cause[2]. In the United States, the acute coronary syndrome (ACS) affects 1.3 million individuals, being 25% men and 38% women who die every year due to AMI[3]. In the case of patients with AMI and ST-segment (STS) elevation, mortality remains high, despite the many therapeutic advances[4].

Despite these facts, our knowledge about the prevalence of risk factors in several populations is still small and almost always based on data supplied by studies carried in populations that are completely different from ours, in order to establish policies for the control of cardiovascular disease.

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Very few studies carried out in Brazil have investigated the characteristics of patients and hospital practices and even less often, their outcome. However, considering that ACS is the main cause of death and one of the most important reasons for hospitalization, it becomes fundamental for the public health system to obtain data on who is hospitalized (age, gender and socioeconomic data), as well as the forms of treatment, in-hospital evolution and outcomes, among other information related to these patients.

In the town of Campos dos Goytacazes, state of Rio de Janeiro, for instance, where the present study was carried out, there are no available data about this area, which has now been supplied by this research. In fact, an almost complete lack of knowledge about the profile of the local population is observed and the ascertaining of these factors can help us to apply more individualized and effective therapeutic measures, leading to a better prognosis and the possibility to guide the healthcare managers into establishing health policies that are more adequate for this specific patient population.

The addition of all these factors was the motivation for this investigation in our town, with the objective of delineating the epidemiological profile of a cohort of patients with a diagnosis

of AMI and STS elevation at hospital discharge, aiming at identifying, within an established set of risk factors, elements capable of discriminating which of them present a higher risk of unfavorable evolution.

Methods

A cohort, observational, prospective and analytical study, involving knowledge from the areas of clinical epidemiology, molecular biology and genetics, was carried out in the town of Campos dos Goytacazes, in the northern part of the state of Rio de Janeiro, Brazil. Demographic data in 2005 recorded a local population of 406,985 individuals (male sex: 196,711; female sex: 210,274), with high urban concentration (364,177 individuals), compared to the rural zone (42,808 individuals) and comprising 112,037 families, of which 32,258 (28.8%) had a monthly income of up to five minimum wages. In the health area, the outpatient clinic and city hospital network had 82 Basic Health Units (BHU), distributed throughout the town and its 14 districts, whereas the hospital network had 1,682 beds, distributed throughout the 10 hospitals, being two public ones, three philanthropic ones and five private ones.

Of these institutions, three had a structured system for the diagnosis of CVD, with Hemodynamics, Interventionist Cardiology and Cardiovascular Surgery Services, which was reduced to only two at the end of the research. Only one of the hospitals had Nuclear Medicine resources. According to the data from the State Health Secretary, in 2005 there were 1,898 deaths due to several causes among men and 1,430 among women; the number of deaths due to CVD among men was 430 (22.65%) and 428 among women (29.93%).

Initially, all ten hospitals participated in the study: *Hospital Escola Álvaro Alvim (AA), Hospital da Beneficencia Portuguesa de Campos (BP), Hospital Ferreira Machado (FM), Hospital dos Plantadores de Cana (HP), Hospital Prontocárdio (PC), Hospital Geral Dr. Beda (DB), Clínica Centrocor (CC), Hospital Geral de Guarus (HG), Hospital Pro-Clinicas (PL) and Hospital da Santa Casa de Misericordia de Campos (SC). After twelve months, due to several reasons, the patients started to be included exclusively at Hospital Escola Álvaro Alvim,* which became the control center of the research.

A total of 500 consecutive patients were included in the study, with a diagnosis of acute coronary syndrome (ACS) in its several presentation forms, thus constituting a record of this pathology in the town of Campos. Regarding the study, however, we used only the information concerning the general population of 351 patients with ACS and the specific data of 158 patients with AMI and STS elevation.

The short-term study was carried out from August 2004 and December 2006, with an assessment during the hospitalization phase in the hospitals that participated in the study.

• Inclusion *criteria:* patients older than 20 years, of both sexes, with ACS, with or without STS elevation; patients who had the first acute coronary event within 72 hours after symptom onset or those who had previous coronary artery disease (CAD).

• *Exclusion criteria:* terminal neoplasic diseases, polytraumatism, dementia, post- or perioperative infarction (not myocardial revascularization surgeries).

• *Diagnosis of acute myocardial infarction with STS elevation:* was considered when the patients presented alteration in factors of myocardial necrosis: increase, followed by gradual decrease in CK-MB or total CK, exceeding twice the upper normal range in at least one measurement within 48 hours of the acute picture onset, or three times the upper normal range in patients submitted to angioplasty in the last 48 hours, associated to electrocardiographic alterations compatible with subepicardial injury – new (or presumably new) J-point elevation in the ST segment, in two or more contiguous derivations ≥ 0.2 mV at V1, V2 and V3 and ≥ 0.1 mV in other derivations – or acute block, or presumably acute, of the left bundle branch.

In the beginning of the study, there was a physician in charge of patient inclusion in every hospital, who was made aware every time there was a hospitalization due to a diagnosis of ACS. The patients were treated by the Emergency Unit Teams of the hospitals, which prioritized the diagnosis and the patients' clinical control. As soon as possible, the respective researcher-physician contacted the patients and their families and obtained the informed consent from them; subsequently, the patient's initial data was collected as well as blood samples, including blood samples for DNA extraction and storage for future analyses of genetic polymorphisms related to cardiovascular diseases.

The included patients were followed regarding their clinical evolution and the clinical and surgical therapies adopted during the hospitalization period, including the complications and clinical outcomes up to the hospital discharge or death. This limitation in the follow-up period of the sample population, i.e., between the hospital admission and discharge, prevented the assessment of the mid- and long-term procedures and outcomes.

There was no interference or control by the study researchers on the type of treatment prescribed for each patient, or regarding the routines established by the several participating hospitals, except concerning some measurements, previously established in the research and approved in meetings with the professionals in charge of the hospitals. Therefore, the medications and the procedures used in these hospitals were the ones that were routinely used, determined by the assistant physicians and the use of experimental medications or techniques was not part of the research.

Statistical analysis

The STATA program, version 9.1, was used to build the database and perform the statistical analysis.

The Student's *t* test was used in the following situation: mean of two dependent variables, if the continuous variable had a normal distribution or more than 50 observations.

If the dependent variable were non-normal and the sample sizes were small (less than 50 observations), the Wilcoxon test was applied when the independent variable presented two categories, or the Krus-Wallis test, when the independent variable presented more than 2 categories. In cases of a nominal dependent variable and a categorical independent variable, the Chi-square test was used to verify the association between the two categorical variables. If at least 80% of the expected frequencies exceeded five and all

the expected frequencies exceeded one, Fisher's test was used: if the expected frequencies were less than 5 and the number of observations, less than 30. In case of an ordinal independent variable, the Wilcoxon's test was used, as previously described.

The files used for recording the patients' data, the results of blood tests and the intra-hospital evolution are attached to the original research project.

The present research, the result of a partnership with the Universidade Federal Fluminense, was approved by the Ethics Committee in Research of the School of Medicine of Campos/Hospital Escola Álvaro Alvim, from Fundação Benedito Pereira Nunes.

The free and informed consent form was signed by all patients, after reading it, according to the guidelines for ethical procedures in genetic research, with emphasis on the population and individual consent, published in 2000 by the Massachusetts Medical Society, based on the Icelandic experience with *de Code genetics* when creating the Iceland Medical Assistance Database (IHD).

Results

Of the 158 patients with AMI and STS elevation, age varied from 22 to 89 years, with a mean of 60.8 years. Of the sample, 65.8% were males, with low level of schooling; 54.4% had less than four years of schooling and only 10.1% had finished College or University. Most of the patients were Catholics (76.5%), used the Public Health System (72.8%) and had a family income of up 5 minimum wages (65.4%), whereas only 14.8% of them earned more than 10 minimum wages.

Cardiovascular risk factors

There was a high prevalence of the main risk factors, except smoking. Diabetes mellitus was found in 24% of the patients, hypercholesterolemia in 35%, family history of coronariopathy in 52.7%, previous coronary artery disease in 15.4% and smoking in 23.4% (Table 1).

The time between the onset of the clinical picture and hospital arrival was < 3 hours for 67.7% of the patients and only 8.4% arrived at the Emergency Hospital 12 hours after the first symptoms. As for the Killip classification, 78.7% were Grade I at the hospital admission (Table 1).

Coronary angiography study

This study was carried out in 148 patients (93.7%), sometime during the hospitalization. Lesions > 70% that affected 264 arterial sites were observed, with a predominance of the anterior descending artery, which was the most often affected one, either alone or in association with other arteries. This artery was also the main responsible for the AMI pictures (57.4%), followed by the right coronary artery (33.8%) and circumflex artery (7.5%). Two trunk lesions (1.4%) were observed, with no responsibility for the acute picture and it was not possible to determine the artery responsible for the aforementioned picture in two patients (1.4%).

Table 1 – Basic data, main risk factors, time to hospital arrival and Killip class on arrival of patients with AMI and STS elevation in Campos dos Goytacazes, RJ, 2004-2006

n	158
Age	Mean of 60.8 years (22-89)
	19.7% < 50 yrs
	27.9% > 70 yrs
Sex	Male 65.4%
Level of Schooling	Up to 4 yrs (54.4%)
	College or University (10.1%)
Religion	76.5% Catholics
Family income (minimum wages)	Up to 5 min. wages (65.4%)
	> 10 min. wages (14.8%)
Health Insurance	72.8% (Public Health System)
People in family	3.3 (mean)
Smoking	37/159 (23.4%)
SAH (%)	91/151 (60.3%)
Diabetes (%)	37/154 (24%)
Hypercholesterolemia (%)	42/120 (35%)
Familial CAD (%)	69/131 (52.7%)
Previous CAD (%)	24/156 (15.4%)
Alcohol consumption	59/156 (27.8%)
Time to hospital arrival	Up to 3 hrs (67.7%)
	> 12 hrs (8.4%)
Killip class on arrival	Killip I (78.2%)
	Killip II, III, IV (21.8%)

SAH - systemic arterial hypertension; CAD - coronary artery disease.

At the moment of the coronary angiography study, the coronary arterial flow was observed in the responsible artery: TIMI 0 in 55 patients (59.1%) and TIMI III in 30 patients (32.6%). In 107 patients (70.5%), the left ventricle ejection fraction, measured by the ventriculography performed during the coronary angiography or, in the absence of the latter, through the echocardiography, was > 55% (Table 2).

Medication use

A low use of the main medications was observed in the studied population, at the hospital admission as well as at the hospital discharge. At the admission, aspirin, as the basic medication for the treatment of these patients, had been used by only 26.2% of them; betablockers by 14%; statins by 9%; and ACE inhibitors by 29.9% of them. The combined use of aspirin, betablockers and statins was used by only 4.5% of the patients. At hospital discharge, aspirin was prescribed to 96.8% of the patients; betablockers to 65.8%; statins to 86.1%; ACE inhibitors to 76% and the association of aspirin, betablocker and statins to only 57% of them (Figure 1).

The initial treatment (Figure 2) carried out in 50 patients (32%) was venous thrombolysis and 10 of them (20%), with

Table 2 – Angiographic data and LV ejection fraction of patients with AMI and STS elevation in Campos dos Goytacazes, RJ, 2004-2006

Number of coronary angiography	148-93.7%
Number of sites with lesions >70%	264
	AD 15 (77.7%)
	CD 81 (54.7%)
	Cx 66 (54.7%)
	LCAT 2 (1.4%)
Number of lesions/pat.	Uniarterial 70.0 (47.3%)
	Biarterial 35.0 (23.7%)
	Triarterial 39.0 (26.4%)
	LCAT 2.0 (1.4%)
	No lesions 2.0 (1.4%)
Involved artery	AD 85 (57.4%)
	RC 50 (33.8%)
	Cx 11 (7.5%)
	Not ident. 2 (1.4%)
Flow at involved artery at TCA (93 patients)	TIMI 0 55 (59.1%)
	TIMI I 6 (6.4%)
	TIMI II 2 (2.1%)
	TIMI III 30 (32.6%)
LVEF	Above 55% 107 (70.5%)
	46% to 55% 30 (19.7%)
	30% to 45% 11 (7.2%)
	Below 30% 4 (2.6%)

DA - anterior descending artery; RC - right coronary artery; Cx - circumflex artery; LCAT - left coronary artery trunk; LVEF - left ventricle ejection fraction.

no recanalization criteria, were referred for rescue angioplasty. The time between the arrival at the hospital and the start of the venous thrombolysis varied from 15 to 360 minutes, with a mean of 89 minutes and 53.1% of the patients started the thrombolytic therapy within the first 60 minutes. A total of 41 patients underwent primary angioplasty (26%) and in about 40% of them, the procedures were carried out within a door-to-balloon time < 90 minutes.

Of these 41 patients, 4 developed precordial pain and signs of ischemia and were submitted to angioplasty after 12 hours. The clinical treatment was maintained for most of the patients (42%), although they arrived at the Emergency Hospital in time for some type of reperfusion to be performed. No surgical treatment was carried out as the initial conduct.

As for the final treatment, during the in-hospital phase, 42 patients were later submitted to coronary angioplasty to treat residual lesions or lesions in other arteries that were not responsible for the acute picture, although they had great functional importance. The myocardial revascularization surgery (MRS) was indicated in 18 patients, of which 12 were carried out, with a total of 31 revascularized arteries (2.6 arteries per patient), with two deaths occurring in the immediate postoperative period, being one of them due to encephalic vascular accident and another to renal failure, in a patient already undergoing dialysis. The others (42%) maintained the clinical evolution, with a record of 11 deaths (21.2%) (Figure 3).

A total of 93 coronary angioplasties were performed, comprehending 139 lesions (1.5 lesions per patient), with the implantation of 121 stents, of which 7 were pharmacological ones (1.3 stents per patient). The use of the intra-aortic balloon was very low, as it was used in only six patients (3.8%); the same occurred with the use of glycoprotein IIb/IIIa inhibitors, indicated for only 10 (6.3%) patients (Table 3).

The angioplasty was unsuccessful in 4 patients (4.3%), two patients (2.2%) presented subacute occlusions, two (2.2%) presented important bleeding at the puncture site, one patient (1.1%) had a LCA dissection and one patient (1.1%) had a pseudoaneurism. There were no deaths during the procedures. However, two deaths (2.2%) occurred during the in-hospital evolution: one due to possible cardiac rupture on the third day of evolution after a successful rescue TCA and another, a triarterial patient, whose angiography was unsuccessful and developed severe ventricular dysfunction and arrhythmia (Table 4).

The general mortality was 9.5%, considering the following treatments: clinical, coronary angiography in its different forms and surgical (Figure 4).

Discussion

The studied population was elderly; however, it included a reasonable number of patients younger than 50 years. Regarding the patients' socioeconomic and cultural data, we observed that the family income was similar to that of the general town population and that 65.4% of the families lived with a maximum income of 5 minimum wages. There was a high prevalence of patients with low level of schooling and approximately 55% of them had finished up to the 4th grade at Elementary School, whereas only 10% of them had finished College or University, factors that have been emphasized in recent publications[5].

The prevalence of the main risk factors was high, except for smoking, which can be explained by the large number of non-smoking women and ex-smokers among the older patients. When comparing the previous history of coronary disease among the groups of patients of our own material – AMI with STS elevation *vs*. unstable angina *vs*. AMI without STS elevation – we observed that a history of previous CAD was less prevalent in the first group, with AMI being the first manifestation of the coronary disease.

Considering the record of the high prevalence of the main risk factors in the present study, there was low previous use of medications and the patients were insufficiently treated, in view of the fact that only 4.5% of them used the three basic associated medications, although these drugs are available in all the pharmacies of the hospital network. These patients were also inadequately medicated at the hospital discharge, when only 57% of them were instructed to use the association of aspirin, betablockers and statins.

There was a high prevalence of coronary angiography

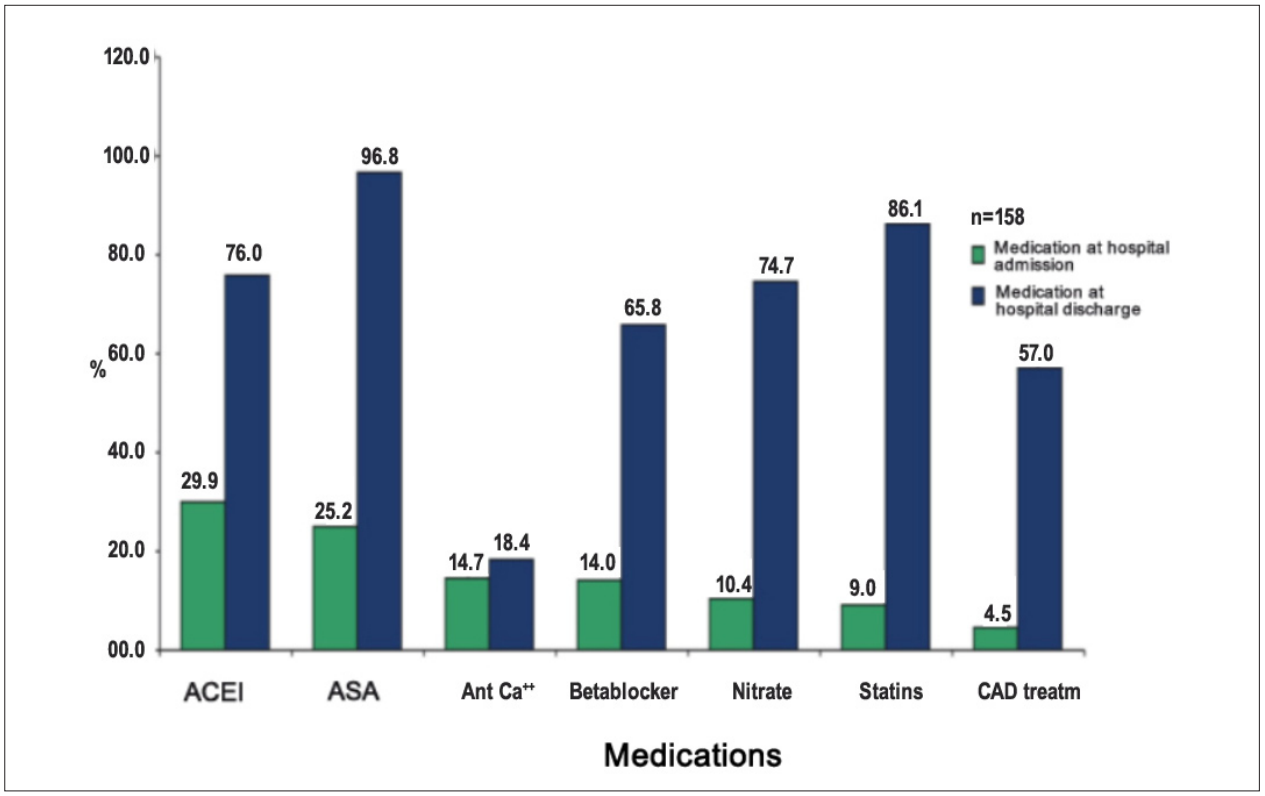

Figure 1 - Medications at hospital admission and hospital discharge of patients with AMI and STS elevation in Campos dos Goytacazes, RJ, 2004-2006; ACEI - angiotensin-converting enzyme inhibitor; ASA - acetylsalicylic acid.

studies (93.7%), perhaps due to the relative difficulty in performing non-invasive assessments for patient stratification, data compatible with those obtained by de Santos et al[6] that performed coronary angiography studies in 92.3% of the patients admitted to hospital with AMI and STS elevation. With the exception of the electrocardiogram, which was carried out in all patients from our study, mostly non-serial, the other assessments such as echocardiogram and myocardial scintigraphy were less used than expected.

There was also a higher availability of the service of hemodynamics during the 24-hour day period and most of these procedures were performed in reference hospitals where the patients were referred to, with a previous indication for coronary angiography study.

Most of the patients arrived at the hospital in time for the mechanical or chemical reperfusion procedure, which, however, was not performed in approximately 35% of them, with much lower rates than the expected ones.

When performed, the treatment with streptokinase (SK) was the most predominant one, followed by primary TCA. The most often used final treatment was the TCA in its different forms (primary, rescue and elective), which was carried out in 59% of the patients, followed by the clinical treatment, carried out in 33% of the patients, and finally, the surgical treatment, in 8% of them. The mortality rates were low for TCA and high for the clinical and surgical treatments; however, this was a small-sized sample, of which patients presented higher comorbidities.

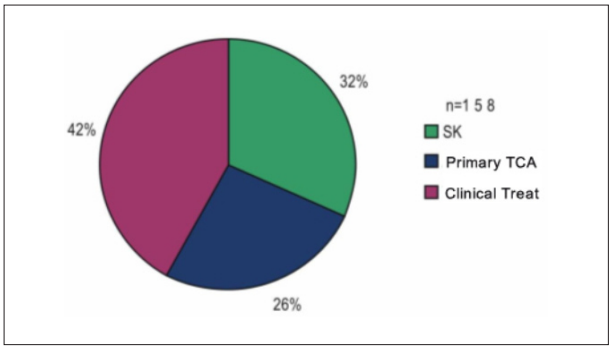

Figure 2 - Initial treatment of patients with AMI and STS in Campos dos Goytacazes, RJ, 2004-2006; SK - streptokinase.

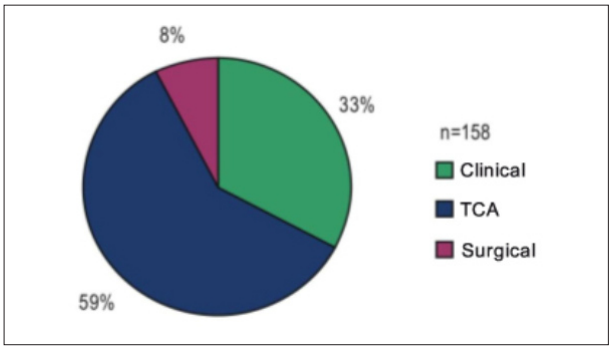

Figure 3 - Final treatment of patients with AMI and STS in Campos dos Goytacazes, RJ, 2004-2006.

Table 3 – Number of lesions treated by TCA, number and type of stents used in patients with AMI and STS elevation in Campos dos Goytacazes, RJ, 2004-2006

	n	(%)
Number of dilated lesions	139	100
TCA with 1 *stent*	69/93	74.1
TCA with 2 *stents*	20/93	21.5
TCA with 3 *stents*	4/93	4.3
Total of *stents* used	121/93	1.3 (mean)
Conventional *stents*	114	
Pharmacological *stents*	7	
Mean of dilated lesions	139/93	1.5 (mean)

TCA - transluminal coronary angioplasty.

Table 4 – Complications related to the coronary angioplasties and evolution of patients with AMI and STS elevation in Campos dos Goytacazes, RJ, 2004-2006

Complication	n (%)	Evolution
Unsuccessful recanalization	4/93 (4.3)	Three with good evolution and one death due to hypopotassemia
Hospital death	2/93 (2.2)	One death due to cardiac rupture 48 hrs after the procedure.
Bleeding	2/93 (2.2)	Good evolution
LCA dissection	1/93 (1.1)	Revascularization surgery with good outcome
Pseudoaneurysm	1/93 (1.1)	Good evolution
Subacute occlusion	2/93 (2.2)	Recanalization (good evolution)

LCA - left coronary artery

Regarding the type of reperfusion treatment adopted, we observed that around 40% of the patients submitted to the primary angioplasty had a door-to-balloon time of up to 90 minutes, which is considered good; and even better, if we take into account the fact that these procedures were mostly carried out in patients treated at general hospitals and referred to a reference hospital, thus including the delay time during the patient's transportation to the reference hospital[7].

It is noteworthy the fact that only 10% of the patients arrived at the Emergency Hospital 12 hours after the symptom onset. We also observed that the type of treatment received presented variations according to the day of week[8] or the Unit teams on duty. Another important fact was that, in some occasions, there were no beds available at the Coronary Units of the town hospitals, even in those with a 24-hour Service of Hemodynamics, which prevented the adequate treatment of some of the patients.

Regarding the use of stents, the conventional type was the predominant one, whereas the pharmacological type was used in only 7 patients, as there are no data in the literature to confirm its benefits on the late evolution of these patients, although it can reduce the number of re-hospitalizations[9]. In total, 139 lesions were treated, in 93 patients (1.5 lesions per patient) and 1.3 stents were used per patient, a number that is very similar to the data published by the National Center of Cardiovascular Interventions[10].

Most of the times, only the responsible artery was treated and no stents were used in 18 lesions. The mortality among patients submitted to TCA was around 2.2%, a percentage that is considered low when compared to that of the clinical and surgical treatments; however, the patients submitted to surgical treatment, with a mortality of 16.7%, presented a higher number of comorbidities.

Additionally, this was a very small sample, from which one cannot draw conclusions. As for the clinical treatment,

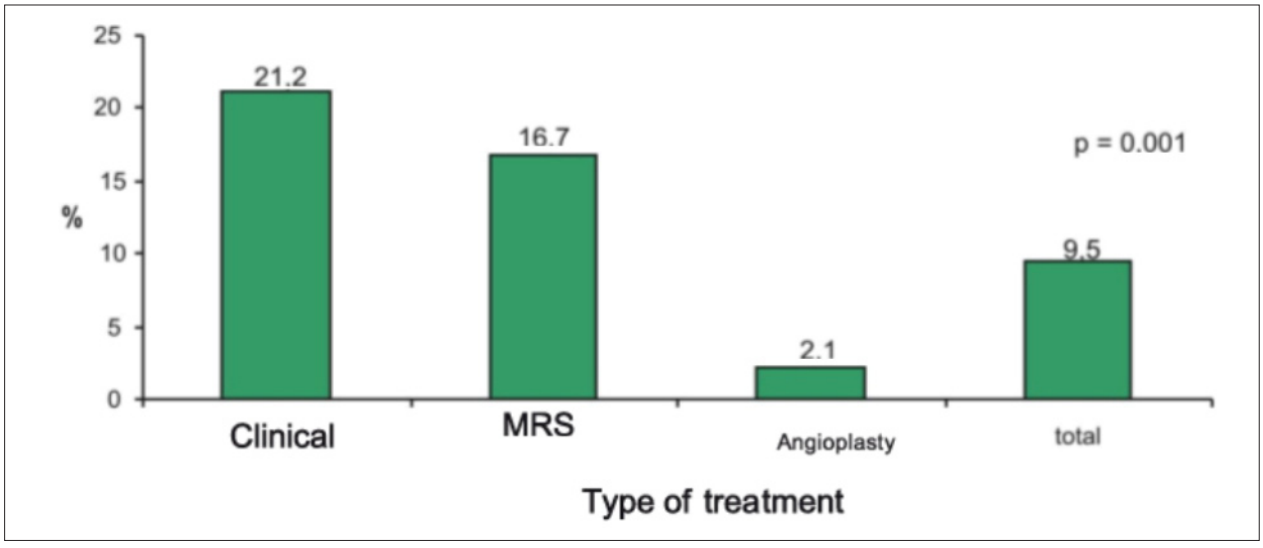

Figure 4 - *Death due to final treatment of patients with AMI and STS in Campos dos Goytacazes, RJ, 2004-2006; MRS - Myocardial revascularization surgery.*

which also presented a high mortality (11/53 =21.2%), it included the group of more severe patients, with ventricular dysfunctions, cardiogenic shock, diffuse multiarterial lesions and severe mitral dysfunctions. We believe that a more invasive approach of this subgroup could have contributed to a better final outcome[11].

The low rate of reperfusion treatment observed in the present study, although reported in several other studies, is not justified in a mid-size town, as in the case of Campos de Goytacazes, which has ten hospitals located downtown, in addition to more than one hundred Basic Health Units distributed along the suburbs, as well as transportation and communication services, roads that are reasonably kept and no major traffic problems, which enables the population to reach the major hospitals within 60 minutes, thus decreasing the door-to-balloon time. In fact, our patients, as a general rule, arrived in time for reperfusion, but did not receive the treatment, which reinforces the need for cardiac emergency service optimization, so that this population can be treated more adequately and thus, contribute to decrease morbidity and also mortality, which presents high rates not only at the hospital phase, but also in the evolution phase, after hospital discharge[12].

We conclude that the mortality of the AMI with STS elevation can be reduced; however, for this objective to be attained, it is necessary to have strategies that are effective in reducing the treatment and reperfusion time, and that the latter – either chemical or mechanical – is actually made available for all patients with AMI[13].

Additionally, it is important to make an adequate clinical support available for all these patients, not only related to the associated medications, but also regarding the procedures that can improve their evolution. In fact, all these procedures have been well established, although they are many times not performed due to the lack of well-trained medical teams and in enough number to attend to the increasing necessity in the cardiology emergency services of the hospitals throughout the country.

Limitations

The present study presents limitations due to the fact that the sample, although representative of a population of a mid-sized city, was small and had a limited follow-up period.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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There were no external funding sources for this study.

Study Association

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