Acute Myocardial Infarction with Persistent ST-Segment Elevation. SCAR (Acute Coronary Syndromes in Argentina) Multicenter Registry from the Argentine Society of Cardiology

Infarto agudo de miocardio con supradesnivel persistente del segmento ST. Registro multicéntrico SCAR (Síndromes Coronarios Agudos en Argentina) de la Sociedad Argentina de Cardiología

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ABSTRACT

Introduction: Acute coronary syndrome registries made by the Argentine Society of Cardiology provide current and comparative information on their evolution, whose analysis allows to know the mortality rate and the different regional treatment patterns, and to evaluate the relationship between outcomes and demographic variables, clinical characteristics and therapy applied in “real life”.

Objectives: To analyze the clinical, therapeutic and outcome characteristics of ST segment elevation acute myocardial infarction (STEMI) included in a multicenter registry conducted by the Argentine Society of Cardiology in 2011.

Methods: Patients diagnosed with STEMI included in the multicenter SCAR (Acute Coronary Syndromes in Argentina) registry were analyzed. Data from centers that participated in the 2005 and 2011 registries were compared.

Results: The study included 476 patients. Twenty-five percent of patients were women, mean age was 61 ± 12.3 years, and 70% received reperfusion therapy: 20% (n = 92) with thrombolitics and 50% (n = 238) with primary angioplasty. In-hospital mortality rate due to STEMI was 8%. Independent predictors of death were age over 70 years (OR 2, 95% CI 1.2-3.3, p = 0.003), not having received reperfusion therapy (OR 1.72, 95% CI 1.1-2.0, p = 0.01) and cardiogenic shock (OR 37, 95% CI 12-117, p < 0.0001). Comparison of the same centers showed that in 2011 the number of cases that did not receive reperfusion therapy was reduced by 30%, with increased use of primary angioplasty [OR 3.7 (95% CI 1.6-4, p < 0.001)]. A reduction of in-hospital mortality [OR 0.40 (95% CI 0.23-0.83, p = 0.01)] was also identified.

Conclusions: Seventy percent of patients with STEMI included in the SCAR registry received reperfusion therapy, while mortality rate was 8%. Compared with 2005, an increase of primary angioplasty and decreased in-hospital mortality was observed, among other findings

Key words: Myocardial Infarction - Epidemiology - Therapeutics - Reperfusion.

RESUMEN

Introducción: Los registros de síndromes coronarios agudos realizados por la Sociedad Argentina de Cardiología aportan información actualizada y comparativa sobre su evolución, cuyo análisis permite conocer la tasa de mortalidad, diferentes patrones de tratamiento regionales y evaluar la relación entre los resultados y variables demográficas, características clínicas y terapéutica aplicada en la “vida real”.

Objetivos: Analizar las características clínicas, terapéuticas y evolutivas del infarto agudo de miocardio con supradesnivel del segmento ST (IAMST) incluidos en un registro multicéntrico realizado por la Sociedad Argentina de Cardiología durante 2011.

Material y métodos: Se analizaron pacientes con diagnóstico de IAMST incluidos en el registro multicéntrico SCAR (Síndromes Coronarios Agudos en Argentina). Se compararon datos de centros que participaron en los registros de 2005 y de 2011.

Resultados: Se incluyeron 476 pacientes. Una cuarta parte fueron mujeres, la edad media fue de 61 ± 12,3 años, el 70% recibió tratamiento de reperfusión: 20% (n = 92) con trombolíticos y 50% (n = 238) con angioplastia primaria. La mortalidad hospitalaria de los IAMST fue del 8%. Fueron predictores independientes de muerte la edad mayor de 70 años (OR 2, IC 95% 1.2-3.3; p = 0.003), no haber recibido tratamiento de reperfusión (OR 1.72, IC 95% 1.1-2.0; p = 0.01) y el shock cardiogénico (OR 37, IC 95% 12-117; p < 0.0001). Comparando los mismos centros, en 2011 se redujo en un 30% el número de casos que no recibieron tratamiento de reperfusión, con un incremento del uso de la angioplastia primaria [OR 3,7 (IC 95% 1.6-4; p < 0.001)]. Se detectó también una reducción de la mortalidad hospitalaria [OR 0,40 (IC 95% 0.23-0.83; p = 0.01)].

Palabras clave: Infarto del miocardio - Epidemiología - Tratamiento – Reperfusión.
**INTRODUCTION**

Coronary heart disease still remains a public health problem in Argentina. Registries are useful to know the mortality rate, the different patterns of regional treatment and to evaluate the relationship between outcomes and demographic variables, clinical characteristics and therapeutics applied in “real life”.

The GRACE registry showed worse prognosis after acute myocardial infarction (AMI) in patients from Latin America compared with those of Europe and the United States. (1, 2) International data registries may not be representative of what occurs in Argentina, due to health policy differences and the healthcare system organization.

For this reason, the registries made by the Argentine Society of Cardiology (SAC) since 1987, provide current and comparative information of its evolution, at least among the centers voluntarily participating in these studies.

The SCAR registry (Argentine Registry of Acute Coronary Syndromes), conducted by SAC in 2011, included patients admitted with a final diagnosis of acute coronary syndrome. The main objective of this analysis is to update the current status of patients diagnosed with STEMI and to compare the clinical outcome and therapeutic characteristics of patients in centers that participated in the registry developed by SAC in 2005 and in 2011 (SCAR).

**METHODS**

**Inclusion criteria**

The SCAR registry was conducted by the Research Area and Emergency Cardiovascular Council of the Argentine Society of Cardiology (SAC). It was a cross-sectional, multicenter study whose main objective was to compare the clinical outcome and therapeutic characteristics of patients diagnosed with STEMI and to compare the clinical outcome and therapeutic characteristics of patients in the same participating centers.

Data were collected in a file by investigators from centers associated to the Argentine Society of Cardiology nationwide and sent either by post or through the web.

**Bioethical Aspects**

The protocol was approved by the SAC Ethics Committee. Since personal data and follow-up were not required, an informed consent was not necessary for inclusion in the registry, in agreement with the Habereas Data national law No. 25326 (Data Protection Act of Argentina). Due to the observational character of the registry, behaviors and treatments adopted were performed according to the criteria of each local investigator.

**Population**

**Inclusion criteria for the analysis of AMI:**

- Two of the following three criteria:
  a) Symptoms compatible with myocardial ischemia of at least 20 min duration,
  b) ST segment changes or T wave inversion in two leads compatible with myocardial ischemia or new left bundle branch block (LBBB) or development of new pathological Q waves.
  c) CK Elevation
     - STEMI: ST segment elevation ≥ 1mm in at least two contiguous leads or new LBBB or new pathological Q waves on the ECG.

**Definitions**

Definitions of events considered as endpoints and of the analyzed variables are explained in Appendix 1.

**Center Characterization**

Centers of the Autonomous City of Buenos Aires included in a Census of Intensive Care Units (Coronary Care Units, Multipurpose Intensive Care Units) of the Autonomous City of Buenos Aires and centers in Provinces included in the SAC Regional Districts were invited to participate in the study. The participation was accepted by 87 centers, of which 41% belonged to CABA, 17% to the Greater Buenos Aires and 42% to the provinces. (Appendix 2)

A training system for medical residents was available in 55.2% of hospitals, 77.3% of centers had a Hemodynamics Laboratory (95% during 24 hours) and 74.3% had Cardiovascular Surgery.

**Enrollment**

Patients were consecutively included over a period of three months in each institution. The registry was active from March to October 2011. Onset of inclusion at each site depended on local regulatory or logistic reasons.

**Data**

Data loading into the database was made by each of the participating centers via a web application (https://es.surveymonkey.com/), coordinated by the SAC Research Area. The database was closed once the clearance phase of inconsistent / incomplete data observed in real time was completed. Patient history and coronary risk factors, previous treatment, clinical and electrocardiographic presentation, complementary tests (blood tests, ventricular function assessment, coronary angiography), in-hospital events,
adopted treatment and strategies, both in the acute phase and at discharge, were recorded.

**Statistical Analysis**
Continuous variables are presented as mean ± standard deviation (SD) or median and its 25-75% interquartile range, depending on normal or non-parametric distribution. The t-test and the Wilcoxon rank-sum test were used for comparisons, as applicable. Normality was analyzed by histogram, the relationship between the mean and the median, the skewness and kurtosis values, and by the Shapiro-Wilk test. Qualitative variables were expressed as percentages and were compared using the chi-square test or Fisher’s exact test.

The regression analysis was initiated with a multivariate regression model using the enter and stepwise method. The linearity assumption was corroborated for continuous variables. A p value < 0.05 was considered statistically significant.

All analyses were performed with STATA 9.0 (STATA Corporation, College Station, TX®) software package.

**RESULTS**
Of the 1330 patients in the SCAR registry, 758 presented with AMI: 476 (60.5%) with STEMI and 282 (39.4%) with AMI without ST-segment elevation. Baseline characteristics of the STEMI population are shown in Table 1. Mean age of patients with STEMI was 61 ± 12.3 years, 25% were women, 42% were active smokers, 1 in 5 was diabetic, 50% were dyslipidemic and 63% hypertensive. Seven percent of patients had history of chronic stable angina, 13% of myocardial infarction, 10% of coronary angioplasty (TCA) and 2% of coronary artery bypass surgery.

History of non-cardiovascular diseases and prehospital treatment are also described in Table 1.

**Clinical presentation and initial treatment**
Two thirds of the patients were admitted from home (68.4%), while the remaining third (31.6%) was referred from another medical institution. The median time from onset of symptoms to admission was 120 min. (25-75 IQR: 60-330) and the delay was greater, 240 min (25-75 IQR: 120-510) when the patient was referred from another healthcare center.

Before admission, 25% of patients presented with angina at 24 hours. On admission, 374 patients (79%) were in KK class A, 62 (13%) in KK class B, 11 (2%) in KK class C and 29 (6%) in KK class D.

Initial treatment included: anticoagulation in 50% of patients (61.4% with low molecular weight heparin (LMWH), for a median of 3 days (25-75 IQR: 2-5), 87% with clopidogrel and 13% with prasugrel. Antiplatelet therapy was initiated in the Coronary Care Unit (CCU) in 53% of cases, in the emergency department in 29% of cases, immediately before TCA in 11% of cases and after TCA in 7% of patients. The clopidogrel loading dose was 600 mg in 35% of patients and 300 mg in 62% of patients.

During hospitalization, 99% were treated with aspirin (ASA), 89% with beta blockers, 95% with statins and 81% with angiotensin-converting-enzyme inhibitors (ACEI). Thirteen percent of patients were treated with GPIIb/IIIa inhibitors; the most used was tirofiban (80%), followed by abciximab (10%), and eptifibatide (9%). In 80% of cases, these drugs were infused during the TCA procedure.

Patients with STEMI received reperfusion therapy in 70% of cases, and 92 of these patients were reperfused with thrombolitics (TL) (91% with streptokinase). The time from onset of pain to TL treatment was 180 min. (25-75 IQR: 110-250) and the door-to-needle time was 55 min. (25-75 IQR: 29-90).

A total of 285 patients underwent TCA: 238

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**Table 1. Population characteristics, risk factors, history and previous treatment (n=476)**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n (%) or mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>61 ± 12.3</td>
</tr>
<tr>
<td>Male gender</td>
<td>357 (75)</td>
</tr>
<tr>
<td>BMI</td>
<td>27.9 ± 4.6</td>
</tr>
<tr>
<td>Diabetes</td>
<td>95 (20)</td>
</tr>
<tr>
<td>Diabetic patients treated with insulin</td>
<td>52 (11)</td>
</tr>
<tr>
<td>Smoker</td>
<td>200 (42)</td>
</tr>
<tr>
<td>Ex-smoker</td>
<td>104 (22)</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>242 (51)</td>
</tr>
<tr>
<td>Family history</td>
<td>95 (20)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>299 (63)</td>
</tr>
<tr>
<td>Stress</td>
<td>257 (54)</td>
</tr>
<tr>
<td>Chronic angina</td>
<td>33 (7)</td>
</tr>
<tr>
<td>Previous infarction</td>
<td>61 (13)</td>
</tr>
<tr>
<td>Previous angioplasty</td>
<td>47 (10)</td>
</tr>
<tr>
<td>Previous revascularization surgery</td>
<td>9 (2)</td>
</tr>
<tr>
<td>Hospitalization for heart failure</td>
<td>14 (3)</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease</td>
<td>28 (6)</td>
</tr>
<tr>
<td>Hospitalization for unstable angina</td>
<td>24 (5)</td>
</tr>
<tr>
<td>Stroke</td>
<td>14 (3)</td>
</tr>
<tr>
<td>HIV</td>
<td>6 (1.3)</td>
</tr>
<tr>
<td>Neoplasia</td>
<td>13 (2.9)</td>
</tr>
<tr>
<td>Known coronary obstructions &gt; 50%</td>
<td>85 (18)</td>
</tr>
<tr>
<td>Chronic renal failure</td>
<td>11 (2.3)</td>
</tr>
<tr>
<td>Peptic ulcer</td>
<td>15 (3.2)</td>
</tr>
<tr>
<td>History of hemorrhage</td>
<td>10 (2.1)</td>
</tr>
<tr>
<td>Antiplatelet medication</td>
<td>130 (29)</td>
</tr>
<tr>
<td>Use of ACEI o ARA II</td>
<td>187 (39.3)</td>
</tr>
<tr>
<td>Use of statins</td>
<td>85 (18)</td>
</tr>
<tr>
<td>Use of betablockers</td>
<td>120 (25.2)</td>
</tr>
</tbody>
</table>

patients (83.5%) underwent primary TCA, 29 (10%) rescue TCA, 16 (6%) pharmacoinvasive strategy and 2 (0.7%) facilitated TCA. In 14% of cases drug-eluting stents were implanted. The door-to-balloon time was 107 min. (25-75 IQR: 60-231). In 27.5% (n = 135) of cases, patients were admitted during the weekend. The door-to-balloon time was shorter in patients admitted during weekdays compared to weekends: 95 (25-75 IQR: 50-210) vs. 115 (25-75 IQR: 70-240) minutes, respectively (p = 0.05). The median time between onset of symptoms and first balloon inflation was 240 min. (25-75 IQR: 175-600) in patients who were referred from another institution (p = 0.04).

The reasons for not performing reperfusion therapy are detailed in Table 2.

### In-hospital outcomes and events

Median hospital stay was 5 days (25-75 IQR: 4-7) and CCU stay was 4 days (25-75 IQR: 3-5). Resources used during hospitalization were: intra-aortic balloon pump counterpulsation in 17 patients (3.7%), temporary pacemaker in 25 (4%), mechanical ventilation in 43 (8%) and inotropics in 66 (15%).

Table 3 details in-hospital events, among which the outstanding event was in-hospital death in 38 (8%) patients, most due to cardiac causes (89%).

Table 4 describes mortality by subgroups.

### Comparison between 2005 and 2011 (SCAR) SAC registries

The analysis included 407 patients with STEMI from 28 centers that participated in both SAC registries (2005 and 2011). The definitions of AMI and coronary risk factors were the same in both registries. Table 5 shows the comparison of the demographic characteristics and coronary risk factors, where no significant differences were observed. Patients with AMI from the 2011 registry had a more significant history of coronary disease (AMI, TCA, CABG) and greater use of concomitant therapy (aspirin, beta blockers, statins and ACEI). In 2011, the number of non-reperfused individuals decreased by 30%, at the expense of increased primary angioplasty [OR 3.7 (95% CI 1.6-4) p <0.001] and there was a decrease in the use of throm-
bolytic agents [OR 0.76 (95% CI 0.4-1.2) p <0.0001] (see Table 5).

Cardiogenic shock was the main cause of death in both registries: 75% of deaths were associated with cardiogenic shock in the 2005 registry and 50% in the 2011 registry. Mortality due to STEMI with cardiogenic shock was high in both registries: 45% in 2005 and 56% in 2011. The incidence of cardiogenic shock decreased from 2005 to 2011: OR 0.50 (95% CI 0.27 to 0.90, p = 0.04).

Finally, 60% mortality reduction was observed in STEMI from 2005 to 2011 [OR: 0.40, 95% CI 0.23 to 0.83, p = 0.01]. There were no differences in the prevalence of post-AMI angina, reinfarction or stroke.

**DISCUSSION**

The purpose of this analysis was to describe the evolution and the variables associated with in-hospital outcome in STEMI patients admitted to SAC-related centers.

**Table 5.** Comparison between 2005 and 2011 SAC registries.

<table>
<thead>
<tr>
<th>Registry</th>
<th>2005 (n=203)</th>
<th>2011 (n=204)</th>
<th>OR (CI 95%)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline Characteristics</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Women</td>
<td>50 (25)</td>
<td>44 (22)</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>Age, years, mean ± DS</td>
<td>63 ± 13</td>
<td>63 ± 12</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>Hypertensives</td>
<td>128 (63)</td>
<td>138 (68)</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>Smokers</td>
<td>79 (39)</td>
<td>75 (37)</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>Dyslipidemics</td>
<td>108 (53)</td>
<td>108 (53)</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>Diabetics</td>
<td>40 (20)</td>
<td>45 (22)</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td><strong>History and previous treatments</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AMI</td>
<td>22 (11)</td>
<td>45 (22)</td>
<td>2.1 (1.3-3.3)</td>
<td>0.0001</td>
</tr>
<tr>
<td>TCA</td>
<td>12 (5.8)</td>
<td>30 (15)</td>
<td>3 (1.6-5.6)</td>
<td>0.003</td>
</tr>
<tr>
<td>CABG</td>
<td>4 (1.9)</td>
<td>15 (7.4)</td>
<td>4 (1.5-10)</td>
<td>0.003</td>
</tr>
<tr>
<td><strong>Previous treatment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aspirin</td>
<td>67 (33)</td>
<td>75 (37)</td>
<td>-</td>
<td>NS</td>
</tr>
<tr>
<td>Betablockers</td>
<td>45 (22)</td>
<td>75 (37)</td>
<td>2.1 (1.4-2.9)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Statins</td>
<td>22 (11)</td>
<td>51 (25)</td>
<td>2.7 (1.7-4.3)</td>
<td>0.0001</td>
</tr>
<tr>
<td>ACEI</td>
<td>65 (32)</td>
<td>85 (42)</td>
<td>1.5 (1.1-2.1)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Interval-symptoms-admission, min, median; (25-75 IQR)</td>
<td>222 (135-360)</td>
<td>124 (76-230)</td>
<td>-</td>
<td>0.0001</td>
</tr>
<tr>
<td><strong>Data during hospitalization</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Killip D</td>
<td>24 (12)</td>
<td>16 (8)</td>
<td>0.50 (0.27-0.90)</td>
<td>0.04</td>
</tr>
<tr>
<td>Development of new Q-waves</td>
<td>128 (63)</td>
<td>69 (34)</td>
<td>0.47 (0.34-0.56)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Primary angioplasty</td>
<td>91 (45)</td>
<td>155 (76)</td>
<td>3.7 (1.6-3)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Thrombolytics</td>
<td>75 (37)</td>
<td>45 (22)</td>
<td>0.76 (0.4-1.2)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Without reperfusion</td>
<td>36 (18)</td>
<td>4 (2)</td>
<td>0.70 (0.6-0.9)</td>
<td>0.0001</td>
</tr>
<tr>
<td><strong>Treatment at discharge</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>138 (68)</td>
<td>187 (91.5)</td>
<td>1.9 (1.1-3.4)</td>
<td>&lt;0.05</td>
<td></td>
</tr>
<tr>
<td>Betablockers</td>
<td>152 (75)</td>
<td>173 (85)</td>
<td>4.5 (2.7-7.4)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Statins</td>
<td>136 (67)</td>
<td>162 (79.2)</td>
<td>6 (3.2-12)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>ACEI</td>
<td>82 (40.5)</td>
<td>162 (79.2)</td>
<td>4 (1.21)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Aspirin</td>
<td>178 (87.8)</td>
<td>202 (99.5)</td>
<td>5.2 (1.4-18)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td><strong>Hospital events</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Death</td>
<td>28 (13.8)</td>
<td>12 (6.2)</td>
<td>0.40 (0.23-0.83)</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Mortality
The present study shows 8% in-hospital mortality, which although is somewhat higher than that of other international registries, as the French registry, (3) is comparable to others such as the Registry get with the guidelines (AR-G). (4) It should be mentioned that observational studies have reported geographic differences in treatment that could be related to variations in the mortality rate (5).

In our country, the recently published CONAREC XVII registry found a similar mortality rate of 8.8% (6).

Pharmacological treatment
Treatment with ASA, clopidogrel / prasugrel, statins, ACEI and beta-blockers was high and comparable to international studies. (4, 7)

The value of time to consultation and treatment
The median onset of pain to admission time was 120 min. (25-75 IQR: 60-330), lower than the last 2005 registry made by the Argentine Society of Cardiology (median 240 min.), (8) and similar to the GRACE (150 min; 25-75 IQR: 100-243), (9) Middle East (165 min; 25-75 IQR: 95-272) (10) and PRIAMHO II (175 min) registries, (11) but higher than that reported by García Escudero et al. (12) in a single center (Hospital Argerich) in our country.

The median door-to-balloon time in our registry was 107 min. (25-75 IQR: 60-231), higher than treatment guideline recommendations. (13) In the GRACE registry (9) it was 86 min. (25-75 IQR: 53-135), and 150 min (25-75 IQR: 105-205) in patients transferred to another center, well below that presented in our registry. Distance and travel times may be associated with mortality. (14).

The median door-to-needle time was 55 min. (25-75 IQR: 29-90), higher than guideline recommendations and that reported in the GUSTO-1(15) and GUSTO-3 (16) studies, where the median time was 66 and 54 min., respectively, and also higher than that referred in the GRACE (9) substudy, where it was only 30 min. (25-75 IQR: 18-60). There are clear regional differences between Europe (26 min.), USA (35 min.), Australia / New Zealand and Canada (32 min.) and Argentina / Brazil (49 min.). In most centers in our country reperfusion therapy decision is taken in the intensive care unit, probably causing in-hospital delays. (12)

In different countries, strategies with healthcare education programs and organization of the emergency system have been implemented to simplify and improve the speed to TL or TCA, including the creation of telephone call centers operated by emergency physicians to activate the preparation of the hemodynamics laboratory upon the patient’s first contact with the healthcare system (17-19) or to initiate pre-hospital TL. (20) These programs have reduced reperfusion time (21), door-to-balloon time (22) and door-to-needle time.

Considering the prolonged times observed for primary TCA, mainly in patients referred for angioplasty from another center, the implementation of national and / or regional actions to decrease them would impact on hospital reduction of morbidity and mortality, shortening door-in-to-door-out time, i.e. the time between the arrival and transfer of patients that should be referred for treatment, optimizing transportation times and coordination among the centers.

Reperfusion strategy
The high use of TCA reperfusion therapy compared to TL might be explained by the availability of hemodynamics facilities in our registry [(77.3% of the participating centers had a hemodynamics laboratory (95% with 24-hour availability)]. Widimsky et al. (23) found that primary TCA was the dominant reperfusion strategy in European countries (64% of cases). This trend of increased use of primary TCA as reperfusion strategy is also observed in the GRACE study (from 15% in 1999 to 44% in 2006), with a proportional decrease in TL practice. (24) In Middle East countries the behavior seems to be the reverse, 7.6% received TCA whereas 66% received TL, due to the small number of hemodynamics laboratories. (10) This strategy has wide acceptance among cardiologists, as reflected in other registries. (22, 25)

2005-2011 comparative analysis
It is important to underline the substantial reduction in mortality arising from comparing the same centers that participated in two registries with a 6-year difference, even with demographic characteristics and greater burden of coronary background in the 2011 STEMI results. With the actual sample limitations, multiple concurrent causes could be attributed to this situation, as for example, increased rate of therapeutic reperfusion, development of cardiogenic shock and lower onset-to-admission time. Nevertheless, these results should encourage the optimal use of human and structural resources to reduce this mortality, especially in terms of prevention, early diagnosis and management of cardiogenic shock.

Study limitations
Even though the invitation to participate was not selective (through municipal census and SAC Provincial Districts), once again final acceptance and participation occurs in standard-high complexity centers. The results of this voluntary registry are, therefore, far from reflecting the national situation. Furthermore, and due to financial constraints and the huge number of participating centers, an audit of the data sent by the centers was not performed. With respect to the comparison with the 2011 registry, it is suggested that because the comparison was unadjusted, the differences are presented in a more descriptive way than with the intention of inferring causality.
REFERENCES


REFERENCES

Definitions

1. Diabetes: Diagnosis prior to admission or under dietary or medical treatment
2. Hypertension: Diagnosis prior to admission
3. Tobacco consumption: Current smoker or quitted smoking less than 1 year ago
4. Ex-smoker: Quitted smoking at least 1 year before admission
5. Dyslipidemia: Serum cholesterol levels > 200 mg/dL (if the patient remembers the value), otherwise, previous diagnosis of hypercholesterolemia or lipid-lowering therapy.
6. Family history: AMI or documented coronary disease in the father before 55 years of age or in the mother before 45 years.
7. Sedentarism: Lack of suitable exercise in frequency, intensity and time.
8. Previous medication: Medication regularly received by the patient during the last week prior to admission.
9. Personal history: Diagnosis prior to admission; when date is requested, if he had more than one diagnosis, enter the most recent.
10. ST-segment elevation: ST-segment elevation ≥ 1 mm compatible with myocardial ischemia, in two or more contiguous leads.
11. ST-segment depression: ST-segment depression ≥ 1 mm compatible with myocardial ischemia in two or more contiguous leads.
12. Killip on admission
   a) Without rales or heart failure
   b) Pulmonary rales < lower 1/3 of the lung fields
   c) Acute pulmonary edema: Pulmonary rales > lower 1/3 of the lung fields.
13. Cardiogenic Shock
14. Ventricular hypertrophy: According to Sokoloff’s criteria
15. Previous medication: Medication regularly received by the patient during the last week prior to admission.
16. Personal history: Diagnosis prior to admission; when date is requested, if he had more than one diagnosis, enter the most recent.
17. Hypertension: Diagnosis prior to admission
19. Previous medication: Medication regularly received by the patient during the last week prior to admission.
20. Personal history: Diagnosis prior to admission; when date is requested, if he had more than one diagnosis, enter the most recent.
21. ST-segment elevation: ST-segment elevation ≥ 1 mm compatible with myocardial ischemia, in two or more contiguous leads.
22. ST-segment depression: ST-segment depression ≥ 1 mm compatible with myocardial ischemia in two or more contiguous leads.
23. Killip on admission
   a) Without rales or heart failure
   b) Pulmonary rales < lower 1/3 of the lung fields
   c) Acute pulmonary edema: Pulmonary rales > lower 1/3 of the lung fields.
24. Cardiogenic Shock
25. Pseudonormal T: Positive previously negative or bimodal T waves compatible with myocardial ischemia, in 3 or more contiguous leads.
26. Killip on admission
   a) Without rales or heart failure
   b) Pulmonary rales < lower 1/3 of the lung fields
   c) Acute pulmonary edema: Pulmonary rales > lower 1/3 of the lung fields.
27. Primary angioplasty: Directly performed as first intervention of reperfusion therapy in STEACS patients who have not received any type of coronary reperfusion-oriented medication.
28. Rescue angioplasty: Performed in those patients in whom coronary reperfusion therapy has initially been fibrinolytics, presenting negative reperfusion criteria.
29. Facilitated angioplasty: Prompt percutaneous repair of the infarction culprit artery (<12 h), routine (not rescue) and planned (non-emergency), in STEACS patients initially treated with drug therapy to achieve arterial opening.
30. Pharmacoinvasive strategy: Patients who having received a pharmacological strategy subsequently undergo coronary angiography.
31. Reperfusion Criteria: Evaluated at 120 min of fibrinolytic infusion or post TCA. It involves meeting two of three criteria (classic)
32. Acute renal failure: Impaired renal function accompanied by oliguria and elevated creatinine > 2.0 mg/dL
33. Post AMI angina: New anginal pain or its equivalent, with or without new changes in the ECG, which occurs between 24 hours and 30 days after AMI, and is not accompanied by enzyme release.
34. Recurrent angina: One episode of more than 20 min duration or two episodes lasting more than 5 min.
35. Refractory Angina: Presence of a recurrent episode of ischemic pain at rest of at least 20 min duration or two episodes of more than 5 min duration, associated with new electrocardiographic ST segment changes in the presence of maximal anti-ischemic treatment available in each center, and not meeting AMI criteria.
36. Acute myocardial infarction: Presence of a recurrent episode of ischemic pain of at least 20 min duration, with complete characteristic ischemic electrocardiographic changes and total CPK and/or its MB fraction elevation above twice the upper normal limit.
37. Reinfarction: The presence of at least two of the three conventional criteria was considered:
   a) Recurrent ischemic pain of 30 min or more duration.
   b) New ST-segment elevation in two or more contiguous leads or presence of new Q waves
   c) CPK re-elevation (≥ 50% elevation from the previous value)
38. Stroke: New neurological focus of more than 24 hour duration.
39. Major bleeding: According to TIMI major bleeding, according to GUSTO severe / moderate bleeding.
40. Minor bleeding: According to TIMI minor bleeding, according to GUSTO mild bleeding.
41. Total mortality: It includes all deaths regardless of etiology.

APPENDIX 2

Participating centers and investigators responsible for the SCAR registry

Asociación Española de Socorros Mutuos (Comodoro Rivadavia): Dr. Celia, José Carlos | Dr. Freile, Oscar
CEMEP Rio Grande (Tierra del Fuego): Dr. Grane, Ignacio | Dra. Di Nunzio, Mariela
CEME: Dr. Fuselli, Juan | Dr. Guetta, Javier
Centro Cardiologico del Norte: Dr. Cravez, Ricardo | Dra. Mereles, Laura
Centro Gallego: Dr. Varini, Sergio | Dra. Surc, Patricia
Clínica Bazterrica: Dr. Barrero, Carlos | Dra. Granada, Carolina
Clínica Coronel Suárez: Dr. Caccavo, Alberto | Dr. Sein, Mariano
Clínica Comahue: Dr. López, Enrique
Clínica del Sol: Dr. Gagliardi, Juan
Clínica del Valle (Comodoro Rivadavia): Dra. Seleme, María | Dr. Gil Daroni, Juan
Clínica Independencia: Dr. Pomés Iparaguirre, Horacio | Dr. de Dominicis, Francisco
Clínica La Sagrada Familia: Dr. Inigo, Carlos