Comparison of Two Argentine Registries on Myocardial Infarction: the 2011 SCAR Registry and the 2015 ARGEN-IAM-ST Registry

Comparación de dos registros argentinos de infarto de miocardio: SCAR 2011 y ARGEN-IAM ST 2015

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ABSTRACT

Background: The aim of this study was to compare patients with ST-segment elevation myocardial infarction (STEMI) included in centers participating of two registries in Argentina.
Methods: STEMI patients included in the 54 centers participating in the SCAR (2011) registry and in the ARGEN-IAM-ST (2015) registry were compared.
Results: A total of 676 STEMI patients were analyzed: 222 in the SCAR registry and 454 in the ARGEN-IAM-ST registry. There were no significant differences in age and sex. The use of fibrinolytic agents was significantly lower and the use of primary percutaneous coronary intervention was significantly increased. The incidence of cardiogenic shock was 50% lower. There were no differences in mortality and reinfarction during hospitalization.
Conclusions: The indication of primary percutaneous coronary intervention increased and the use of fibrinolytic agents decreased. Cardiogenic shock decreased significantly in the last 5 years without significant changes in in-hospital mortality.

Keywords: Myocardial Infarction – Epidemiology – Treatment

RESUMEN

Objetivos: Comparar pacientes con infarto agudo de miocardio con elevación del segmento ST (IAMCEST) incluidos en centros participantes de dos registros argentinos.
Material y métodos: Se compararon pacientes con IAMCEST incluidos en 54 centros que participaron tanto en el registro SCAR (2011) como en el ARGEN-IAM-ST (2015).
Resultados: Se analizaron 676 pacientes con IAMCEST; 222 del SCAR y 454 del ARGEN-IAM-ST. No hubo cambios significativos en la edad y el género. Se observó una reducción significativa en el uso de fibrinolíticos, con un incremento de la angioplastia primaria. El shock cardiogénico se redujo a la mitad. No hubo diferencias en la mortalidad y de reinfarto durante la hospitalización.
Conclusiones: Se observó una mayor indicación de angioplastia primaria y una disminución en el uso de fibrinolíticos. El shock cardiogénico se redujo significativamente en los últimos 5 años, sin cambios significativos en la mortalidad hospitalaria.

Palabras clave: Infarto de miocardio – Epidemiología – Tratamiento

Abbreviations

AMI	Acute myocardial infarction	**CABGS**	Coronary artery bypass graft surgery
STEMI	ST-segment elevation myocardial infarction	**UFH**	Unfractionated heparin
PCI	Percutaneous coronary intervention	**ACEI**	Angiotensin-converting enzyme inhibitor

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INTRODUCTION

According to WHO records, cardiovascular disease is currently one of the leading causes of mortality worldwide (3 out of 10 deaths) and accounts for about 158 deaths per 100,000 inhabitants in high-income countries, and 95 deaths per 100,000 inhabitants in low- and middle-income countries. (1, 2)

Several randomized trials have demonstrated that the management of acute myocardial infarction (AMI) has undergone significant changes over the past years. The advent of pharmacologically effective drugs and the increasing use of invasive strategies as first-choice therapy have demonstrated beneficial effects on major adverse outcomes such as death, reinfarction and cardiogenic shock. (3-6)

In this setting, hospital records are useful to determine how and to what extent the new evidence and recommendations of clinical practice guidelines are being applied in the real world. In most cases they reflect suboptimal management, including underutilization of reperfusion therapy and drugs with demonstrated efficacy. (7)

Consequently, the aim of this study was to compare the clinical and epidemiological characteristics, strategies and treatments used and the in-hospital course of patients hospitalized with ST-segment elevation myocardial infarction (STEMI) enrolled in the 54 participating centers of the 2011 SCAR Registry (8) and the 2015 ARGEN-IAM-ST Registry. (9)

METHODS

The analysis compared the following variables: demographics, coronary risk factors, history of cardiovascular disease, prehospital and in-hospital treatments, interventions and in-hospital events of STEMI patients with <24 evolution hours since onset of symptoms included in the centers participating in both multicenter Argentine registries.

The comparable variables present in both registries were used to build a database. Patients with <24 h evolution were included in the analysis and the in-hospital data were analyzed. The methods used in both registries has been previously described. Briefly, the SCAR registry included consecutive patients within the entire spectrum of acute coronary syndromes (STEMI and non-ST-segment elevation acute coronary syndromes) over a three-month period from March to October 2011. Only STEMI patients were analyzed for this comparative analysis.

The national ARGEN-IAM-ST registry was developed together by the Argentine Society of Cardiology and the Argentine Federation of Cardiology with the participation of 247 centers nationwide. Only STEMI patients were consecutively included in each center during a period of three months. A pilot phase was conducted between November 2014 and March 2015 in selected centers and was then extended nationwide until December 31, 2015.

Patient characteristics (age, gender, risk factors, history, comorbidities), clinical presentation (location of myocardial infarction, Killip and Kimball class on admission and time of evolution), treatment used (antiplatelet therapy, reperfusion and adjuvant therapy) and in-hospital clinical outcome (heart failure, post-infarction angina, shock and death) were recorded.

Delays for achieving an effective treatment were considered. STEMI was defined as the presence of at least two of the following criteria: symptoms suggestive of myocardial ischemia during at least 20 minutes, ST-segment elevation >1 mm in at least two contiguous leads or new complete left bundle branch block.

Statistical analysis

Discrete variables were expressed as percentages and quantitative variables with parametric and non-parametric distribution were presented as mean and standard deviation or median with the corresponding 25-75% interquartile range, respectively. The distribution of data was evaluated assessing kurtosis and skewness and with the Wilk-Shapiro test. The chi square test was used to compare qualitative variables, and quantitative variables were analyzed using Student's t test or the Mann-Withney-Wilcoxon test, depending on sample distribution. A p value <0.05 was considered statistically significant. Statistical analyses were performed using SPSS 17.0 statistical package for Windows.

Ethical considerations

Both registries were conducted following the recommendations of Good Clinical Practice Guidelines and were approved by the Bioethics Committee of the Argentine Society of Cardiology.

An informed consent was not required because no personal or surveillance data were necessary to include patients in the registry, according to the Argentine Habeas Data (Personal Data Protection) law 25,326.

RESULTS

A total of 676 STEMI patients admitted to the 54 centers participating in both registries were included in the analysis: 222 in the SCAR registry and 454 in the ARGEN-IAM-ST registry. Sixty-four percent of the centers had a residency program in cardiology, 84% had percutaneous coronary intervention (PCI) capabilities and 78% had cardiovascular surgery services. According to the geographical distribution of the centers, 48% belonged to the Autonomous City of Buenos Aires and 52% were from the inland part of the country, including the outskirts of the city of Buenos Aires.

Baseline population characteristics are described in Table 1. There were no significant differences in age and gender between both registries. The prevalence of current smokers was higher in the ARGEN-IAM-ST registry without differences in the proportion of patients with diabetes, dyslipidemia and hypertension or in the history of chronic angina, AMI, PCI or myocardial revascularization surgery.

The time interval from the onset of symptoms to admission was not significantly different (about two hours): 129 (60-247) minutes in the SCAR registry and 136 (68-291) minutes in the ARGEN-IAM-ST registry.

Anterior myocardial infarction was present in about 50% of the population in both studies. Although the proportion of patients undergoing reperfusion therapy was similar in both studies, the use of fibrinolytic agents was lower and PCI was higher in the AR-

GEN-IAM-ST registry. Again, streptokinase was the fibrinolytic agent most commonly used in Argentina (between 97% and 100% of the cases). When the use of antithrombotic and antiplatelet agents was analyzed in the ARGEN-IAM-ST registry, the indication of bivalirudin increased, clopidogrel and glycoprotein IIb-IIIa inhibitors were less commonly administered and the use of prasugrel remained without percent differences.

As there was no information about the useof ticagrelor in the SCAR registry, it was not possible to compare this variable with its use in the ARGEN-IAM-ST registry. Almost all patients received aspirin during hospitalization. The use of nitroglycerin declined in the ARGEN-IAM-ST registry. There were no differences in the use of inotropic agents and diuretics (Table 2). The use of temporary cardiac pacing decreased and mechanical ventilation was more com-

Table 1. Comparison of baseline data, coronary risk factors and cardiovascular history between both registries

	SCAR	ARGEN-IAM-ST	p
Mean age, (years ± SD)	60.1 ± 12	60.6 ± 12	ns
Women, n (%)	61 (27.5%)	97 (21.4%)	ns
Smoking habits, n (%)	91 (41.7%)	290 (69%)	0.0001
Dyslipidemia, n (%)	106 (50.2%)	179 (42.9%)	ns
Hypertension, n (%)	136 (61.8%)	240 (54.2%)	ns
Diabetes, n (%)	43 (19.5%)	89 (21%)	ns
Chronic angina, n (%)	14 (6.6%)	18 (4.1%)	ns
Previous AMI, n (%)	24 (10.9%)	42 (9.7%)	ns
Previous PCI, n (%)	24 (10.9%)	46 (10.5%)	ns
Previous CABGS, n (%)	3 (1.4%)	8 (1.8%)	ns

AMI: Acute myocardial infarction. PCI: Percutaneous coronary intervention. CABGS: Coronary artery bypass graft surgery.

Table 2. Comparison of in-hospital outcomes between both registries

	SCAR	ARGEN-IAM-ST	p
ST-segment elevation in anterior leads, n (%)	119 (53.6%)	201 (46.1%)	ns
Reperfusion, n (%)	220 (99%)	438 (96%)	ns
Fibrinolytic agents, n (%)	4 (18%)	24 (10.8%)	0.001
Primary PCI, n (%)	196 (89.2%)	434 (95.6%)	0.002
RTPA, n (%)	0 (0%)	1 (0.2%)	ns
Streptokinase, n (%)	17 (7.7%)	17 (3.7%)	ns
TPA, n (%)	1 (0.5%)	0 (0%)	ns
UFH, n (%)	34 (15.3%)	91 (20%)	ns
Enoxaparin, n (%)	35 (15.8%)	77 (17%)	ns
Bivalirudin, n (%)	1 (0.5%)	24 (6%)	0.001
GP IIb/IIIa inhibitors, n (%)	30 (13.5%)	42 (10%)	0.001
Clopidogrel	185 (84.5%)	321 (72.3%)	0.001
Prasugrel, n (%)	37 (16.9%)	54 (13.2%)	ns
Aspirin, n (%)	220 (99.5%)	450 (99.6%)	ns
IV nitroglycerin, n (%)	162 (74%)	245 (57%)	0.001
Calcium channel blockers, n (%)	5 (2.3%)	3 (0.7%)	ns
Beta blockers, n (%)	198 (89%)	198 (45%)	0.001
ACEI, n (%)	176 (81.5%)	192 (44.5%)	0.0001
Statins, n (%)	210 (94%)	390 (91.3%)	ns
Inotropic agents, n (%)	32 (14.9%)	47 (11.2%)	ns
Diuretics, n (%)	47 (22.2%)	92 (22%)	ns
Intraaortic balloon pump, n (%)	9 (4.1%)	7 (3.5%)	ns
Swan Ganz catheter, n (%)	11 (5.1%)	16 (7.8%)	ns
MV, n (%)	22 (10.2%)	40 (19.3%)	0.008
ECV, n (%)	19 (8.7%)	31 (6.8%)	0.09
Temporary PCM, n (%)	17 (7.9%)	19 (4.2%)	0.06

RTPA: Recombinant tissue plasminogen activator. TPA: Tissue plasminogen activator, UFH: Unfractionated heparin. GP: Glycoprotein. IV: Intravenous. ACEI: Angiotensin-converting enzyme inhibitors. PCI: Percutaneous coronary intervention. MV: Mechanical ventilation ECV: Electric cardioversion. PCM: Pacemaker.

mon in the ARGEN-IAM-ST registry (Table 3).

Regarding in-hospital events, there was a reduction in mechanical complications in the ARGEN-IAM-ST registry, while the prevalence of cardiogenic shock post-AMI and post-infarction angina achieved a significant 50% reduction. There were no significant differences in the number or reinfarctions and in-hospital mortality (Table 3).

DISCUSSION

The temporal comparison of AMI records has become a tool to measure how well the real world of our patients adheres to the results of controlled studies, guidelines and recommendations. (10-12)

The Argentine Society of Cardiology has been conducting these registries in the country for almost 30 years in order to identify AMI clinical characteristics, presentation, treatment and in-hospital course, and has made comparative analyses of different registries to directly compare these data over time.

During the four-year period analyzed, there were no changes associated with risk factors such as hypertension, diabetes or dyslipidemia, but the prevalence of smoking increased from 41.7% to 69%, similar to the results of some registries such as the KAMIR (13, 14) and GRACE (15) registries with a prevalence of 62.8% and 59.8%, respectively.

Over the past decade, the price of cigarettes in Argentina has increased less than the population's income. Tobacco has become more affordable and Argentina has become one of the countries with the cheapest cigarettes in the world. Between 2001 and 2015, tobacco sales increased by almost 16.7%. Perhaps this could be the reason of the higher prevalence of smoking and of the lack of impact of current control policies on tobacco consumption. (16, 17)

However, we should bear in mind that this is a descriptive study, and therefore it does not allow establishing a definitive relationship between what has been observed and the results. Despite in the three National Surveys of Risk Factors conducted in 2005, 2009 and 2013 in the general population the prevalence of tobacco use fell from 29.7% in 2005 to 27.1% in 2009 and to 25.1% in 2013, this trend does not nec-

essarily have to be fulfilled in a similar way in a population of AMI patients.

Percutaneous coronary intervention is the predominant reperfusion strategy that increased over the four-year period from 89.2% to 95.6%, in line with guideline recommendations. This increase has been described in other registries; in the United States, the use of PCI increased from 38% to 72% from 1990 to 2006, with a concomitant sustained reduction in the number of patients undergoing thrombolytic therapy. (18)

The European registry shows inequalities in relation with the reperfusion strategy used: the use of PCI is low mainly in the regions of Southern and Eastern Europe. However, there was an increase in the use of PCI between 2007 and 2011 in 13 of the 37 participating countries; for example, over that period, England and Wales reported an increase from 40% to 90%. (19)

The use of mechanical ventilation (MV) showed a significant increase (10.2% vs. 19.3%). Several publications demonstrate that the risk of mortality is three times higher in these patients, with in-hospital mortality rates of 43%, 50.9% and 48% in the GRACE, ARIAM (20) and German BEAT registries (21), respectively.

Hersch et al. (22) reported that MV was a predictor of ventricular dysfunction in the course of AMI, and Kouraki et al. (23) indicated that the need for orotracheal intubation was due to non-cardiac causes in 13% of the cases, such as coma (17%), infections (14%), sepsis (10%) and multiple organ failure (6%). Several authors (24, 25) cannot establish a cause-effect relationship between mechanical ventilation, outcomes and an unfavorable clinical course, and interpret that they may be more related with the complications of mechanical ventilation, such as ventilator-associated pneumonia, delirium or respiratory distress syndrome. When they compared patients with MV vs. those without MV, they observed less use of cardiovascular drugs due to the presence of contraindications associated with comorbidities as a probable cause of greater mortality; yet, this could not be definitely determined.

In our registry, a significant reduction in the rate

	SCAR	ARGEN-IAM-ST	p
Mortality	14 (6.3%)	38 (8.6%)	ns
Reinfarction	4 (1.8%)	7 (1.5%)	ns
PIA	10 (4.5%)	8 (1.8%)	ns
Mechanical complications	8 (3.6%)	1 (0.2%)	0.001
Killip and Kimball class 1	151 (68.6%)	345 (77.7%)	0.05
Killip and Kimball class 2	39 (17.7%)	71 (16%)	ns
Killip and Kimball class 3	7 (3.2%)	7 (1.6%)	ns
Killip and Kimball class 4	23 (10.5%)	21 (4.7%)	ns
Acute AF	16 (7.4%)	21 (4.6%)	ns

Table 3. Comparison of in-hospital course between both registries

PIA: Postinfarction angina. AF: Atrial fibrillation.

of cardiogenic shock (from 10.5% to 4.7%) was observed, and contradictory results have been reported in the literature. One registry performed in France (26) reported a reduction from 6.9% to 5.7% between 1995 and 2005 and the AMIS Plus registry (The Acute Myocardial Infarction in Zwitzerland), (27) reported a reduction from 10.6% to 2.7% between 1997 and 2006, while Goldberg et al. did not find differences (3.7% vs. 2.7%) between 2001 and 2011. (28)

The crude mortality rate between the two periods was slightly higher (6.3% and 8.6%), although the difference was not statistically significant. This percentage did not differ much from the one described in some countries of the Euro Heart Survey (29), where in-hospital mortality ranged between 3.1% and 6.1% in patients undergoing PCI and overall mortality independent of treatment between 3% and 12%. On the other hand, the number of patients included does not have sufficient power to establish statistically significant differences and this would require at least twice as much number of patients. In addition, when the 95% confidence interval for mortality in both records is analyzed, we observe that the limits of the interval overlap: 6.3% mortality in the SCAR registry and 8.61% in the ARGEN-IAM-ST registry (Table 3). Another reason to consider is the relatively short period of four years between both registries to detect such difference.

There are references in the literature that show that the cause of non-cardiovascular mortality has increased by 34% over the past years in patients treated with PCI, mostly due to infections. (30) Studies performed in patients after PCI (chiefly in AMI patients) demonstrated that 42% of the deaths were due to non-cardiovascular causes and that infections were the most common etiologies. The authors agree that the higher non-cardiovascular mortality is primarily related to higher prevalence of non-cardiovascular comorbidities, such as kidney failure. (31) In view of this information, perhaps we should bear in mind that besides adhering to the recommendations of guidelines for the management of cardiovascular diseases, comprehensive strategies should be developed to reduce AMI mortality.

We did not find a rational explanation for the remarkable decrease in the indication of beta-blockers and ACEIs between the two registries that can be related to their association with risk factors, complications or clinical presentation. Unfortunately, we lack information about ventricular function; however, we consider that there may have been some type of involuntary under-registration of drugs, and that the actual number was higher than reported.

The reduction in the incidence of mechanical complications due to their very low prevalence may be associated with diagnostic limitations (availability of imaging studies) that may occur in emergency situations.

The initiation of the Continuous STEMI Registry carried out by the Argentine Society of Cardiology and the Argentine Federation of Cardiology, will enable accurate information of these temporary changes in the near future, with a greater number of centers, patients (larger samples with higher power) and variables analyzed in the comparisons, with constant definitions.

Study limitations

The study has several limitations that should be considered to interpret the results. Undoubtedly, in this comparative analysis, the profile of the centers involved in both registries does not represent the reality of the country (predominantly academic centers, with residency programs and PCI capabilities operating 24 hours a day, 7 days per week), due to the characteristic voluntary nature of this type of registries nationwide and worldwide. On the other hand, although this is a retrospective analysis, STEMI patients were consecutively included, and thus it may be representative of their respective populations. Definitely, as we have mentioned, the sample size in this database is insufficient to assess the prevalence of mortality. Finally, no data quality analyses were performed by external audits to verify the information of each investigator with the source document.

CONCLUSIONS

Once again, a comparative analysis of STEMI shows an increase in the use of PCI as a predominant reperfusion treatment in this type of centers, and a decrease in serious conditions as mechanical complications and cardiogenic shock. Although no changes in mortality were observed, it still remains below the historical values of the national registries (> 10%).

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