

# Registry of Quality of Medical Care for Acute Myocardial Infarction at Buenos Aires Public Hospitals

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## SUMMARY

### Background

The prognosis of patients with acute myocardial infarction does not seem to have improved in our country during the last decades according to the last surveys of the Argentine Society of Cardiology. Indicators of quality have been elaborated as part of an initiative to reduce the gap between practical management and theoretical recommendations about how to treat these patients.

### Objective

To document the quality of current medical practice in the management of acute myocardial infarction in public hospitals depending on the Government of the City of Buenos Aires.

### Material and Methods

We included a prospective cohort of 145 patients with acute myocardial infarction and indication of reperfusion therapy.

### Results

Most patients underwent reperfusion treatment with angioplasty or thrombolytic agents. The use of drugs of proven efficacy was almost 90%. The proportion of patients treated with thrombolytic agents within the recommended time intervals was 30%, similar to those of patients admitted to centers with catheterization laboratory facilities and treated with primary angioplasty. In patients transferred to hospitals for primary angioplasty, door-to-balloon time was <90 minutes in less than 3% of patients.

### Conclusions

These results suggest that quality of medical care for patients with myocardial infarction is adequate, yet there are still delays in the implementation of reperfusion therapy, either thrombolysis or invasive reperfusion techniques.

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**Key words >** Myocardial Infarction - Thrombolytic Treatment - Angioplasty

<b>Abbreviations &gt;</b>	<b>RA</b>	Rescue angioplasty	<b>PTCA</b>	Percutaneous transluminal coronary angioplasty
	<b>AMI</b>	Acute myocardial infarction		

## BACKGROUND

Cardiovascular disease is the leading cause of death and morbidity in the Western world. (1) It is expected that the increase in cardiovascular mortality in developing countries will exceed that of developed countries. (2, 3) In Argentina, one out of three men and women die of cardiovascular diseases. (4)

Acute myocardial infarction (AMI) represents one of the most threatening manifestations of heart disease. A population study performed in Coronel Suarez has reported 9 hospitalizations per 10,000 inhabitants per year as indicator of annual incidence of infarction. (5) Other estimations have calculated

that between 36,000 and 42,000 hospitalizations per year are due to AMI. (6)

Despite significant progress in terms of diagnosis, treatment and prognosis since the sixties, AMI still remains a challenge for daily cardiology practice. According to the surveys from the Argentine Society of Cardiology, in-hospital mortality rates in our environment have remained stable in the last two decades despite the introduction of measurements of proven benefit in terms of survival. (7)

One of the possible explanations for these findings is that not all the diagnostic and therapeutic tools, specially the reperfusion strategies, are used in all

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patients. (8) Thus, almost 50% of patients admitted to medical centers receive neither thrombolysis nor primary angioplasty. In addition, about 20% of patients with AMI who are theoretically eligible for reperfusion therapy do not receive any of these strategies. (9) Prolonged time delays to treatment have been observed; in a group of patients transferred for primary angioplasty, median door-to-balloon time was 210 minutes. (10)

The American College of Cardiology and the American Heart Association (ACC/AHA) have developed performance measurements to reduce the gap between the real management of patients with AMI and the recommendations about how they should be treated. As part of these measurements, several quality indicators for patients care have been developed, stimulating measuring these indicators as one of the main tools to improve the quality of care in AMI.

The first publication has focused on the processes of medical care and on different practice patterns, as the indication of medications based on the recommendations of the practice guidelines. (11) Subsequently, other measures were introduced: structure measures, outcomes measures and efficiency measures, based on a methodology preestablished by the ACC/AHA. (12) These variables have gained an interest additional to representing the standards of care of patients with infarction, as they constitute a reference for external auditing and for reporting outcomes to services providers. Even more, they may constitute a valuable tool to bring scientific evidence closer to daily practice.

In our environment, there are a few studies reporting quality indicators in this disease. For this reason, we have developed a registry to evaluate the quality of current management of AMI in order to identify the opportunities of improvement.

The goal of this study was to document the quality of current medical practice in the management of acute myocardial infarction in public hospitals depending on the Government of the City of Buenos Aires, using quality indicators.

## MATERIAL AND METHODS

### Study design and population

We conducted a multicenter, prospective and observational cohort study. All patients consecutively admitted to the coronary care units or polyvalent intensive units of the 11 hospitals depending on the Government of the City of Buenos Aires with diagnosis of ST-segment elevation acute coronary syndrome within 24 hours from symptoms onset were included in the study. Need for urgent reperfusion treatment was defined as the presence of angina lasting more than 20 minutes and changes in the electrocardiogram (persistent ST-segment elevation in at least two consecutive leads or new or presumably new left branch bundle block) within 12 hours after symptoms onset.

The information from each patient was collected in individual records specially designed for this study. For patients transferred to other centers participating in the registry, data were collected in both centers, ensuring that duplicate information was not entered. All the forms containing data from all the participant centers underwent centralized monitoring to verify the consistency of the information collected with the data registered in the medical records.

### Definition of endpoints

Data were collected from the following performance measurements in treatment, diagnostics and patient education dimensions of care during hospitalization:

- Proportion of use of aspirin before hospitalization.
- Proportion of aspirin prescribed at discharge.
- Proportion of beta blockers prescribed at discharge.
- Proportion of statins prescribed at discharge.
- Proportion of use of angiotensin-converting enzyme inhibitors or angiotensin II receptor blockers.
- Proportion of use and type of reperfusion therapy.
- Time to thrombolytic therapy (door-to-needle time): the interval between arriving at the hospital and starting thrombolytic treatment.
- Time to primary angioplasty (door-to-balloon time): the interval between arrival at the first center and balloon inflation.
- Proportion of evaluation of systolic left ventricular function.
- Proportion of smoking cessation advice.

### Statistical Analysis

Discrete variables were expressed as percentages and continuous variables as means  $\pm$  standard deviation or medians with their corresponding 25-75% interquartile range for non-Gaussian variables. The results were compared using the chi-square test with Yates correction or Fisher's exact test for discrete variables. Continuous variables were compared using the Student's t test for unmatched pairs or Wilcoxon rank sum test, as applicable. Statistical analysis was performed using Stata Statistical Software: Release 11. College Station, TX: StataCorp LP.

## RESULTS

A total of 145 patients from 11 centers were consecutively registered from June to November 2009. Mean age was 60.9 years and 80% were men; basal characteristics are detailed in Table 1.

Most patients were admitted in Killip and Kimball class A (84.1%); 10.4% in class B and 5.5% presented cardiogenic shock. At admission, 86.8% of patients had indication of reperfusion treatment, 9.7% were beyond the 12-hour time window from symptoms onset, and 3.5% had spontaneous reperfusion. Less than 5% of patients had contraindications to receive thrombolytic agents.

Among the participant centers, only 6 centers had only the possibility of thrombolytic therapy and 5 centers also had angioplasty facilities.

### Quality indicators

The results are summarized in Table 2.

In patients with an indication of reperfusion, 33.6% received thrombolysis (streptokinase in all cases); 61.6% underwent primary angioplasty (almost 50% were patients transferred to centers with angioplasty facilities) and 4.8% did not receive any reperfusion strategy.

Almost all patients received aspirin at arrival (98.6%) and clopidogrel during hospitalization (97.9%); low-molecular-weight heparin or fondaparinux were administered to 42.4%.

Left ventricular systolic function was determined in 134 patients (93%); the results are shown in Table 2. At discharge, 97.8% of patients were using aspirin, 95.6% were on statins and 92.6% on beta blockers; 82.4% of patients of the general population and 88.2%

**Table 1.** Basal characteristics

Variables	n	%
Male gender	116	80.0
Age $\pm$ SD, years	60.9 $\pm$ 12.1	
Hypertension	89	61.4
Diabetes	32	22.1
Dyslipemia	63	43.5
Smoker	84	57.9
Former smoke	28	19.3
[fuzzy] Previous AMI	19	13.1
Previous aspirin	33	22.8
Killip & Kimball at admission		
Class 1		84.1
Class 2		10.4
Class 3		0
Class 4		5,5
Indication for reperfusion therapy		86.8
Time from symptoms onset		
0-6 hours		81.6
7-12 hours		8.8
> 12 hours		9.6
Localization		
Anterior		41.5
Inferior		23.6
Combined		30.6
Lateral		4.3
Contraindications for thrombolysis		4.9

of those with moderate or severe left ventricular dysfunction were receiving angiotensin-converting enzyme inhibitors or angiotensin II receptor blockers. Smoking cessation advice was high (89%).

Median door-to-needle time was 47.5 (30-85) minutes; thrombolysis started in 30 minutes or less in only one third of patients (Figures 1 and 2). Door-to-needle time was 45 (20-60) minutes in those centers without angioplasty facilities (n = 25), similar to that of the centers with angioplasty capabilities (n = 17): 50 (30-90) minutes (p = ns).

Median door-to-balloon time was 162 (105-250) minutes in patients treated with primary angioplasty. The proportion of patients treated within 90 minutes was 30% in patients admitted to centers with catheterization laboratory facilities and 2.9% in patients transferred for angioplasty. In the latter group, median door-to-balloon time was 200 (160-300) minutes, with a median delay of 130 minutes in the first center and 30 minutes for patient transportation. In patients admitted to centers with angioplasty facilities and treated in situ, door-to-balloon time was 120 (83-180) minutes.

No major complications were reported during patients' transportation. In-hospital mortality was 3% and the incidence of reinfarction was 5%.

**Table 2.** Quality indicators

Indicators	
<b>Therapeutic dimension</b>	
Reperfusion therapy, %	95.2
Thrombolytic therapy, %	33.6
Angioplasty, %	61.6
Time to reperfusion	
Door-to-needle time (med, IQR), min	47.5 (30-85)
Door-to-needle < 30 min, %	33.3
Total door-to-balloon time (med, IQR), min	162.5 (105-250)
Total door-to-balloon < 90 min, %	15.3
In situ door-to-balloon (med, IQR), min	120 (83-180)
In situ door-to-balloon < 90 min, %	30.0
Delay in 1st center in transfer patients (med, IQR), min	130 (60-220)
Door-to-balloon time in transfer patients (med, IQR), min	200 (160-300)
Door-to-balloon time in transfer patients < 90 min, %	2.9
Aspirin at discharge, %	97.8
Statins at discharge, %	95.6
Beta blockers, %	92.6
ACEI or ARB in moderate or severe LVD, %	88.2
LMWH or fondaparinux, %	42.4
Clopidogrel, %	97.9
<b>Diagnostic dimension</b>	
LVSF evaluation, %	93.1
preserved, %	41.8
mild dysfunction, %	17.2
moderate dysfunction, %	28.3
severe dysfunction, %	12.7
Patient education dimension	
Smoking cessation advice, %	88.9

Med: Median. IQR: Interquartile range ACEI: Angiotensin-converting enzyme inhibitor. ARB: Angiotensin II receptor blocker. LVSF: Left ventricular systolic function. LMWH: Low-molecular-weight heparin.

## DISCUSSION

The introduction of reperfusion therapy with thrombolysis and PTCA was a great advance for the treatment of AMI. The reduction in mortality demonstrated by randomized trials and confirmed with meta-analyses was subsequently corroborated in daily practice ("the real world") by comparative registries of different time intervals. (13-15)

PTCA produces higher reperfusion rates than thrombolysis, with greater reduction in mortality, about 1% compared to TPA. (14) Therefore, it is reasonable to infer that, in patients with AMI, overall mortality should decrease as more patients undergo

primary angioplasty instead of thrombolytic therapy. Rescue angioplasty (RA) has also proved to be efficient to reduce reinfarction and mortality in patients with failed reperfusion with thrombolysis. (16)

However, the different surveys conducted in our country by the Argentine Society of Cardiology in the thrombolytic era have not demonstrated any reduction in mortality due to AMI despite a significant increase in the indication of primary angioplasty and RA. (7)

Time delay on reperfusion therapy for AMI is the time between the onset of symptoms and the initiation of a reperfusion strategy - either intravenous thrombolysis or PTCA. This time interval is composed of three main delay times: a) time from symptoms onset to contact with the emergency medical system; b) time between the first medical contact with the patient and hospital arrival; and, c) time between patient's arrival and initiation of reperfusion therapy. The first of these components depends on the patient, the second on the prehospital emergency care systems and the last one on the emergency department staff. In the latter, the delay will depend not only on the time taken to start intravenous thrombolysis (door-to-needle time) or to insufflate the balloon (door-to-

balloon time) but also on the time taken for patient transportation to another hospital to undergo coronary angiography with or without previous use of thrombolysis. Door-to-needle time and door-to-balloon time are directly related with mortality; the prognosis is worse with longer intervals. (17-21)

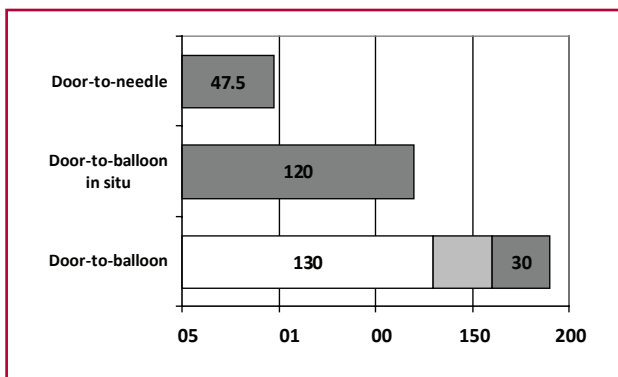
It has also been demonstrated that patients transport to hospitals with PTCA facilities is feasible and safe, reducing the rate of events (especially reinfarction) compared to in-hospital thrombolysis. These differences seem to decrease or disappear when primary angioplasty is compared with prehospital thrombolysis, particularly during the first hours from the onset of symptoms, with the advantage that it may be implemented by paramedics. (22, 23)

However, the studies that have compared these strategies deserve to be questioned as they might not be applicable in daily practice ("the real world"). In this way, the randomized studies reporting a reduction in combined (stroke, reinfarction and death) or isolated (stroke and reinfarction, but not death) major events, have been conducted under ideal conditions in specific settings, achieving time delays that seem difficult to reproduce in daily practice. The National Registry of Myocardial Infarction in USA (NRMI-3/4) reported that among patients transferred for PTCA, the median total door-to-balloon time was 180 minutes, with only 4.2% of patients treated within 90 minutes, the benchmark recommended by guidelines. (24) The investigators of this registry have recently reported that by 2006 this percentage has increased to 8.8%, a number that is far from 34.1% in 1994 and 65.7% among nontransfer patients. (18)

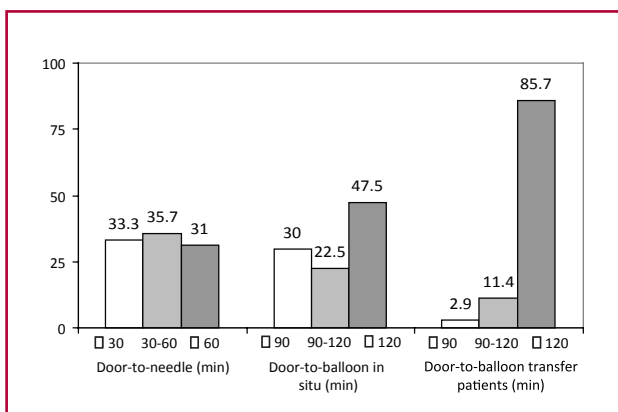
In our study, considering optimal door-to-needle time < 30 minutes and door-to-balloon time of 90 minutes to achieve reduction in mortality, we have found that these times were accomplished by only 33% of patients treated with thrombolysis and 15% of those undergoing PTCA (with and without transportation). It is extremely alarming that time delay in patients transported to undergo PTCA instead of thrombolysis in situ was 200 minutes.

This information is similar to delays in PTCA in AMI reported by a single center in the city of Buenos Aires. (25)

Ambulance transport time has been adequate considering the urban setting with complex and heavy traffic. In contrast, the time between arrival at the first center and ambulance departure is unacceptably long. Two possible reasons may explain this delay: the decision to transfer the patient takes too long or there is a prolonged delay in the medical transportation system to arrive at the referral hospital. Our data is insufficient to draw definite conclusions. However, the combination of both reasons may be responsible for this delay. Anyway, a significant reduction in the delay would undoubtedly produce a benefit in patients' prognosis, even in terms of survival, as it is well demonstrated that long door-to-needle and door-to-



**Fig. 1.** Time delays (minutes) to infusion of thrombolytic agents and to coronary angioplasty (medians). In situ: Angioplasty in non-transfer patients.



**Fig. 2.** Frequency of distribution of door-to-needle and door-to-balloon intervals in the different periods. In situ: Angioplasty in non-transfer patients.

balloon times worsen the prognosis of AMI.

There is an easy way to improve this problem. The treatment guidelines for AMI developed by the Argentine Society of Cardiology recommend starting thrombolytic therapy when the expected time to primary angioplasty is > 90 minutes. Other studies or registries suggest the use of pre-hospital thrombolysis, but this option has not been evaluated yet in our country. (26, 27)

The use of a pre-hospital ECG was associated with a greater use of reperfusion therapy, faster door-to-needle and door-to-balloon times, and a suggested trend for a lower risk of mortality. However, the use of this low complexity and low cost resource seems to be reduced even in highly developed countries as the USA, where pre-hospital ECG is performed to less than 10% of patients with AMI. (28, 29) In our environment, public ambulances in the emergency medical services do not have electrocardiogram systems.

It may be interesting to compare the results of this survey with those obtained in another survey conducted in the same hospitals a decade ago. (30) The most striking advance is the increased number of PTCA performed currently compared to the previous survey (1%), due to the greater use of this technique all around the world and to the development of PTCA capabilities in our hospitals. The use of aspirin, beta blockers and angiotensin-converting enzyme inhibitors has increased.

Although the international registries have demonstrated a significant reduction in AMI-related mortality, this has not happened in our country. Probably, this difference has multiple causes; yet one of them may be related with time delays. The greater use of PTCA instead of thrombolysis is useful when it is performed in due time and manner. A door-to-balloon time exceeding by 90-120 minutes the door-to-needle time produces loss of the advantages of PTCA on reperfusion. (31) Our study does not let us know why the patients transferred for PTCA were not treated with thrombolysis in the referral hospital.

Fortunately, we should mention that the use of other treatments recommended for AMI - antiplatelet drugs, beta blockers, angiotensin-converting enzyme inhibitors and statins - has increased compared to the results of the 2005 SAC survey. (9)

#### Study Limitations

Measuring time intervals always has an expected margin of error similar to that seen in other national or international registries.

The study was not designed to evaluate rate of events, as mortality or reinfarction. We only mentioned these events for informative purposes; they should not be taken as representative of the reality due to the small sample size until they are verified by studies with larger populations. Possibly, some deaths occurring at the ER before admission to the coronary care units might not have been reported;

another explanation could be random effects due to the sample size.

#### CONCLUSIONS

Our study shows that that quality of medical care for patients with AMI is adequate, yet there are still delays in the implementation of reperfusion therapy, not only thrombolysis but also invasive reperfusion techniques. The necessary mechanisms to avoid these delays must be implemented as soon as possible to save more lives in patients with this condition, the leading cause of mortality in our country and all around the world.

#### RESUMEN

##### Registro de calidad de atención del infarto agudo de miocardio en los hospitales públicos de la ciudad de Buenos Aires

##### Introducción

El pronóstico de los pacientes con infarto agudo de miocardio no parece haber mejorado en las últimas décadas en nuestro país, según las encuestas realizadas por la Sociedad Argentina de Cardiología. Se han elaborado indicadores de calidad como parte de una iniciativa para reducir la brecha entre el manejo práctico y las recomendaciones teóricas acerca de cómo se deberían tratar estos enfermos.

##### Objetivo

Documentar a través de indicadores de calidad la práctica actual en el manejo del infarto agudo de miocardio en hospitales del Gobierno de la Ciudad de Buenos Aires.

##### Material y métodos

Se incluyó una cohorte prospectiva de 145 pacientes con diagnóstico de infarto agudo de miocardio e indicación de terapia de perfusión.

##### Resultados

En la mayoría de los pacientes se instituyó tratamiento de perfusión, ya sea con angioplastia o con trombolíticos. La tasa de empleo de drogas de probado beneficio fue cercana al 90%. La proporción de pacientes tratados con trombolíticos dentro de los tiempos recomendados fue del 30%, similar a la de los pacientes admitidos en centros con hemodinamia y tratados con angioplastia primaria. Por otra parte, entre los enfermos transferidos entre hospitales para angioplastia primaria, el tiempo puerta-balón fue menor de 90 minutos en menos del 3% de los pacientes.

##### Conclusiones

Los resultados sugieren que la calidad de atención de los pacientes con infarto es adecuada, excepto en lo relativo al tratamiento de perfusión, donde persisten demoras en el empleo tanto de trombolíticos como de las técnicas invasivas de perfusión.

**Palabras clave** > Infarto del miocardio - Trombolíticos - Angioplastia

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HGCBA Bernardino Rivadavia: Enrique Dominé.

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