

# Reduction in Door-to-Needle Time to Meet Clinical Guideline Recommendations. Outcomes After 1 Year

Cosme García-García,<sup>a</sup> Lluís Recasens,<sup>a</sup> Nuria Casanovas,<sup>a</sup> Faustino Miranda,<sup>a</sup> Francisco del Baño,<sup>b</sup> Josep M. Manresa,<sup>c</sup> Antoni Serra,<sup>a</sup> and Jordi Bruguera<sup>a</sup>

<sup>a</sup>Servicio de Cardiología, Hospital del Mar, Barcelona, Spain

<sup>b</sup>Servicio de Urgencias, Hospital del Mar, Barcelona, Spain

<sup>c</sup>Asesoramiento Metodológico en Investigación Biomédica, Institut Municipal d'Investigació Mèdica, Barcelona, Spain

The aim of this study was to reduce the door-to-needle time in patients with ST-elevation acute myocardial infarction by setting up a chest pain service. We compared the door-to-needle time and outcomes at the end of first year of follow-up in patients who received fibrinolysis in the 2 years before implementation of the service (Group 1) and those who received fibrinolysis in the 2 years after its creation (Group 2). In Group 1, the median door-to-needle time was 40 min ( $P_{25-75}$ , 23-52 min); in Group 2, it was 27 min ( $P_{25-75}$ , 15-43 min;  $P=.003$ ). In addition, the use of reperfusion therapy increased from 55.2% in Group 1 to 64.7% in Group 2 ( $P<.01$ ). After a follow-up period of 1 year, there was no difference in the rate of revascularization, hospital readmission, reinfarction or cardiovascular mortality.

**Key words:** *Infarction. Fibrinolysis. Reperfusion. Door-to-needle time.*

## Reducción del tiempo puerta-aguja a los objetivos recomendados en las guías clínicas. Pronóstico a 1 año de seguimiento

El objetivo del estudio es disminuir el tiempo puerta-aguja en el infarto con elevación del ST mediante la creación de un *box* de dolor torácico. Se compara el tiempo puerta-aguja entre los pacientes que recibieron fibrinolisis en los 2 años previos a la creación del *box* (grupo 1) y los que se sometieron a trombolisis en los 2 años siguientes (grupo 2), y el pronóstico a 1 año de ambos grupos.

En el grupo 1, la mediana de tiempo puerta-aguja fue de 40 ( $P_{25-75}$ , 23-52) min y en el grupo 2, 27 (15-43) min ( $p = 0,003$ ). Se incrementó el tratamiento de reperusión del 55,2% en el grupo 1 al 64,7% en el grupo 2 ( $p < 0,01$ ). A 1 año de seguimiento, no hubo diferencias en la revascularización, el reingreso, el reinfarto o la muerte de causa cardiovascular.

**Palabras clave:** *Infarto. Fibrinolisis. Reperusión. Tiempo puerta-aguja.*

## INTRODUCTION

Reperfusion strategies in ST-segment elevation acute myocardial infarction (STEMI) remain controversial.<sup>1</sup> The earlier fibrinolysis is administered, the more efficient it is.<sup>2</sup>

Guidelines on STEMI<sup>3</sup> recommend door-to-needle times of <30 min for fibrinolysis and door-to-balloon times of <90 min for primary angioplasty. Analysis of

the real-life context reveals time to myocardial reperfusion continues to exceed recommendations.<sup>4</sup>

The main objective of the present study is to analyze the influence of a new protocol to facilitate rapid identification of patients with STEMI and thus reduce time to reperfusion, bringing it closer to guideline objectives. The secondary objective is to analyze intrahospital and 1-year prognosis before and after introducing the new protocol.

## METHODS

On February 1, 2004, the chest pain service—located in the emergency room (ER) at a point as near as possible to the patient and ambulance entrance—became operational. It consisted of a an electrocardiogram (ECG) and a defibrillator, in order to conduct early

Correspondence: Dr. C. García García.  
Servicio de Cardiología. Hospital del Mar.  
Pg. Marítim, 25-29. 08003 Barcelona. España.  
E-mail: CGarciaG@imas.imim.is

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**TABLE 1. Baseline Characteristics of Patients Treated With Fibrinolysis<sup>a</sup>**

	Group 1, Before Introducing the Service (n=71)	Group 2, After Introducing the Service (n=80)	P
Age, mean (SD), y	61.8 (12.1)	64.4 (13.4)	.20
Women, %	20	26.3	.17
Diabetes, %	20.8	30	.20
High blood pressure, %	40.3	53.8	.09
Dyslipidemia, %	49.4	51.3	.87
Smoking, %	48.1	46.3	.87
Previous AMI, %	13	10	.56
Location of AMI, %			.013
Anterior	37.7	57.5	
Inferior	62.3	42.5	
Prehospital delay, median (P <sub>25-75</sub> ), min	100 (60-155)	120 (65-182)	.23

<sup>a</sup>AMI indicates acute myocardial infarction; SD, standard deviation.

ECGs on patients attending for chest pain, independently of angina type. If ST-segment elevation is identified, the duty cardiologist is called immediately to decide on the reperfusion strategy; if ST-elevation is not identified, patients are reclassified at a lower level of priority.

Between January 20, 2002 and January 31, 2004, 134 consecutive patients with STEAMI were admitted to the coronary care unit (CCU). Between February 1, 2004 and February 1, 2006, 161 consecutive patients with STEAMI were admitted. We prospectively recorded time to reperfusion and analyzed baseline characteristics and clinical course. We compared time to reperfusion in patients who received fibrinolysis before (group 1) and after (group 2) introducing the chest pain service. We evaluated intrahospital and 1-year prognosis in both groups, analyzing readmissions for cardiovascular cause, revascularization, non-fatal reinfarction, and cardiovascular death.

The reperfusion therapy used with most patients was fibrinolysis as our center has had a cardiac catheterization laboratory since June 2003. Consequently, we focus on the analysis of door-to-needle time, from arrival at ER to fibrinolysis. We briefly mention cases of primary angioplasty in the series, without considering their clinical course.

### Statistical Analysis

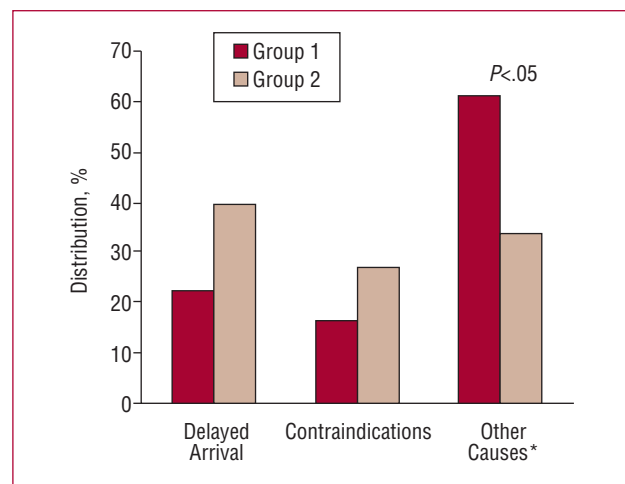
We used SPSS® 12.0 for Windows for statistical analysis. Continuous quantitative variables with a normal distribution were analyzed with Student *t* test and expressed as mean and standard deviation. Quantitative variables with a non-normal distribution were analyzed with the Mann-Whitney *U* test and expressed as median and first and third quartiles. Dichotomous variables were compared with Pearson  $\chi^2$ . We considered  $\alpha \leq .05$  was statistically significant.

## RESULTS

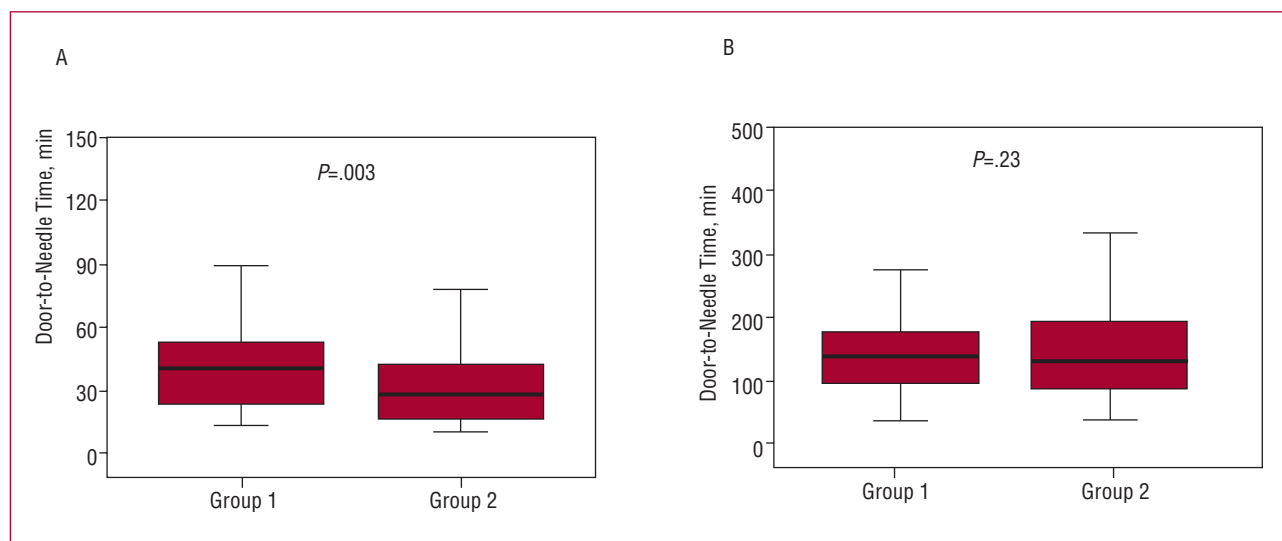
Group 1 consisted of the 71 patients receiving fibrinolysis of 134 admitted with STEAMI (53% thrombolysis) between January 20, 2002 and January 31, 2004. Group 2 consisted of the 80 patients receiving thrombolysis (49.7%) of 161 admitted between February 1, 2004 and February 1, 2006. Baseline characteristics of both groups appear in Table 1.

### Myocardial Reperfusion Therapies

In group 1, 53% of patients received fibrinolysis, whereas 2.2% underwent primary percutaneous transluminal coronary angioplasty (PCTA). In group 2, 49.7% received thrombolysis and 15% underwent primary PCTA. Thus, 55.2% of patients in group 1 were reperfused versus 64.7% of those in group 2 ( $P < .01$ ). Causes of non-reperfusion appear in Figure 1.



**Figure 1.** Causes of nonreperfusion. \*Other causes: doubts over diagnosis, late diagnosis, absence of pain.



**Figure 2.** A: box plot of door-to-needle time. B: box plot of myocardial ischemia time.

### Time to Myocardial Reperfusion

Median ( $P_{25-75}$ ) door-to-needle time was 40 (23-52) min in group 1 and 27 (15-43) min in group 2 ( $P=.003$ ). Creating the chest pain service led to a 30% reduction in time to myocardial reperfusion. The distribution of these times appears in Figure 2A. Fibrinolysis was administered in <30 min to 30.6% of patients in group 1 and 56.3% of patients in group 2 ( $P=.002$ ).

Reduced door-to-needle time was not associated with reduced ischemia time (from onset of pain to thrombolysis). Median ischemia time ( $P_{25-75}$ ) was 150 (105-195) min in group 1 and 144 (97-212) min in group 2 ( $P=.23$ ). The distribution of these times appears in Figure 2B. Fibrinolysis was administered at the first 3 h to 64.9% of patients in group 1 and 66.3% in group 2 ( $P=.86$ ).

In patients undergoing primary PCTA, median ( $P_{25-75}$ ) door-to-balloon time was 150 (124-170) min in group 1 and 75 (60-122) min in group 2 ( $P=.18$ ).

### Intrahospital Clinical Course and Prognosis at 1-Year Follow-up

Intrahospital clinical course and 1-year prognosis appear in Table 2. Follow-up data is available for 90.1% of patients in group 1 and 93.7% in group 2.

### DISCUSSION

Success in treating STEAMI is based on minimizing myocardial ischemia time but recommended objectives<sup>3</sup> are difficult to achieve in daily clinical practice (median door-to-needle time recorded in Spain's PRIAMHO II<sup>4</sup> registry was 48 min).

**TABLE 2.** Intrahospital Clinical Course and Prognosis at 1-Year Follow-up<sup>a</sup>

	Group 1, Before Introducing the New Service (n=71)	Group 2, After Introducing the New Service (n=80)	P
Intrahospital clinical course			
CCU stay, mean (SD), d	4.2 (3.6)	3.4 (2.7)	.01
Killip III-IV, %	11.6	8.8	.63
Intrahospital mortality, %	7	5	.68
Prognosis at 1 year			
Readmission for CV cause, %	23.3	22.5	.85
Non-fatal reinfarction, %	13.3	14.1	.73
Revascularization, %	28.8	52.1	.005
Revascularization, <sup>b</sup> %	42.8	52.1	.20
CV cause mortality, %	9.3	10.7	.67

<sup>a</sup>CCU indicates coronary care unit; CV, cardiovascular; SD, standard deviation.

<sup>b</sup>Since June 2003 when the cardiac catheterization laboratory opened in our center.

Delayed administration of fibrinolytics is due to a wide range of factors such as attending hospital at night or using private transport (ie, not using the ambulance service). Avoiding patients' need to attend ER<sup>5</sup> or improving transport, as in the Vienna registry,<sup>6</sup> increased the use of reperfusion and cut time intervals. Rapid identification of patients with STEAMI is one objective of chest pain units, although more infrastructure is required.<sup>7</sup>

The new protocol requires no increase in medical personal and minimal additional cost as it is based on prioritizing patients with chest pain. Thus, we achieved a thrombolysis rate of 56% at the first 30 min, which is higher than the 46% reported by McNamara et al<sup>8</sup> and similar to that of the GRACE registry, in which median door-to-needle time fell from 35 to 30 min, between 1999 and 2004.<sup>9</sup>

In patients with STEAMI, prognosis at 1 year depends on many factors—eg, prehospital delay<sup>10</sup>—which seriously affect ischemia time. Hence, the reduction of door-to-needle time alone seems, a priori, insufficient to achieve long-term improvements in clinical course. Concerted action is necessary and the population needs to be better informed about coronary heart disease and on improvements in the speed of and access to the ambulance service.

However, we found many group 2 patients required revascularization, which can only be explained by the availability of a cardiac catheterization laboratory at our center since June 2003. It is well known that the availability of a technique in a center increases demand for it. If we only analyze patients admitted after June 2003, the difference in revascularization disappears.

In our center, optimizing existing resources by creating a priority chest pain service, has enabled us to reduce door-to-needle time in patients with STEAMI and attend most of these within the clinical practice guideline objective, although this percentage needs increasing further.

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