ORIGINAL ARTICLE

Predictors of primary percutaneous coronary intervention delay in cases of myocardial infarction diagnosed in hospitals without hemodynamic support systems

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Objetive. The need for primary percutaneous coronary intervention in hospitals without hemodynamic support capability is associated with delays between first medical contact (FMC) and reperfusion. It is important to identify factors involved in delays, particularly if they are relevant to the organization of emergency services.

Methods. Analysis of a registry of patients treated in hospitals without advanced hemodynamic support systems in a catchment area with an established care network for acute ST-segment elevation myocardial infarction (STEMI). The registry included care times.

Results. The network served 2542 patients with a mean (SD) age of 63 (13) years. FMC-to-reperfusion time was within 120 minutes in 42% of the cases. Nine of the hospitals had a chest-pain unit in the emergency department, and this factor was an independent predictor of FMC-to-reperfusion times of 120 minutes or less (odds ratio, 0.64; 95% CI, 0.54–0.77; $P < .0001$); the time was shortened by 11 minutes in such hospitals. FMC-to-reperfusion was delayed beyond 120 minutes in relation to the following factors: shock and need for intubation at start of care, age, gender, FMC at night, left bundle branch block, and Killip class. One-month and 1-year mortality rates increased in hospitals without hemodynamic support systems in proportion to reperfusion delay, by 1.7% and 3.5% if the delay was 106 minutes or less and by 7.3% and 12.4% if the delay was 176 minutes or longer ($P < .0001$).

Conclusions. FMC-to-reperfusion time in STEMI exceeds recommendations in 58% of the hospitals without hemodynamic support systems and delay is inversely proportional to the availability of an emergency department chest pain unit. One-month and 1-year mortality is proportional to the degree of delay.

Keywords: Myocardial infarction. Reperfusion. First medical responders. Hospitals without hemodynamic support. Chest pain unit, emergency department.

Predictores de demora en el intervencionismo coronario percutáneo primario en el infarto de miocardio diagnosticado en hospitales sin hemodinámica

Objetivos. La indicación de intervencionismo coronario percutáneo primario (ICPP) en hospitales sin hemodinámica (HSH) se asocia con tiempos primera asistencia-apertura de la arteria (TPA) prolongados. Es pertinente identificar los factores implicados, especialmente aquellos relacionados con la organización de los servicios de urgencias.

Método. Análisis de un registro de pacientes atendidos en HSH en una región sanitaria con una red asistencial para infarto agudo de miocardio con elevación del segmento ST (IAMEST) establecida y de sus tiempos de actuación.

Resultados. En 2.542 pacientes, de edad 63 ± 13 años, se alcanzó un TPA ≤ 120 minutos en un 42% de casos. En 9 de los 16 HSH analizados existía un box de dolor torácico en el área de urgencias, que se comportó como factor predictor independiente de un TPA ≤ 120 minutos [OR 0,64 (IC 95% 0,54-0,77), p < 0,001], con una reducción de 11 minutos de este. Se asociaron de forma independiente con un TPA superior a 120 minutos la intubación y *shock* durante la primera asistencia, edad, sexo, atención en horario nocturno, bloqueo de rama izquierda y la clase Killip. La mortalidad al mes y al año aumentó en los HSH proporcionalmente al TPA (1,7% y 3,5% si TPA ≤ 106 minutos y del 7,3% y 12,4% si TPA ≤ 176 minutos, p <0,001).

Conclusiones. El TPA alcanzado en activaciones procedentes de HSH supera las recomendaciones en el 58% de casos y se relaciona inversamente con la disponibilidad de un box de dolor torácico en urgencias. La mortalidad al mes y al año es proporcional al grado de retraso en la reperfusión.

Palabras clave: Infarto de miocardio. Reperfusión. Primera asistencia médica. Hospitales sin hemodinámica. Box de dolor torácico.

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All authors have confirmed their authorship in the author responsibilities document, publication agreement and assignment of rights to EMERGENCIAS.

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Information about the article:
Received: 27-5-2020
Accepted: 30-6-2020
Online: 17-2-2021

Editor in charge:
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Introduction

Percutaneous coronary intervention (PCI) performed within the recommended times is the therapy of choice in ST-segment elevation myocardial infarction (STEMI)[1]. Patients initially treated in hospitals without hemodynamic support (HWHS) have a time delay of up to 5 times longer[2] between the first medical contact (FMC) and reperfusion due to delays in diagnosis and interhospital transfer[3]. In cases with homogeneous distance and orography between hospitals, the transfer time should be less, with the time dedicated to diagnosis having a greater impact on delays. Both the inertia generated by the operation of the PCI programs[4] and the organization of hospital emergency departments (ED) could contribute to shortening action times[5], but there is very little information on the real impact of the latter aspect in daily clinical practice.

Therefore, the objectives of this study were: a) to analyze the time to reperfusion in patients with STEMI undergoing PCI and initially attended in HWHS in the health region under study; b) to identify variables associated with time to reperfusion, especially those linked to the organization of the ED, and c) to analyze the association between time to reperfusion and mortality in these patients.

Method

Organization of the reperfusion circuit

The organization of the PCI program in the reference region has been described previously[2,6]. It is a coordinated care network to provide acute-phase reperfusion therapy for STEMI, distributed among several referral hemodynamic hospitals (HH). Healthcare in Catalonia is divided into 7 territories. The health region analyzed includes 66% of the population (4,996,165 inhabitants) and has 7 HH and 16 HWHS. If the first care is provided in a basic healthcare area (BHA), a HWHS or by the out-of-hospital Emergency Medical System (EMS), the EMS will be responsible for transferring the patient to the corresponding HH. Fibrinolysis is indicated in cases where FMC is expected to exceed 120 minutes. All cases in which this reperfusion circuit is activated are systematically included in a mandatory community registry, managed and audited by the health department of the institution responsible for the health area in question.

Study population and variables analyzed

All patients residing in Catalonia who, after activation of the circuit in a HWHS of the health region analyzed, were treated with PCI and between 2010 and 2016 were consecutively included. Therefore, fibrinolyzed patients were excluded.

The following time intervals were analyzed: onset of pain-first assist, first medical contact-electrocardiogram (FMC-ECG), first medical contact-circuit activation (FMC-CA), arrival at HWHS-start of transfer (DIDO or "door-in to door-out"), first FMC, and total ischemia time. Artery opening was defined as the moment of passage of the intra-coronary guidewire. The initial contact with health care personnel capable of interpreting the electrocardiogram (ECG) was considered the first visit, and those cases attended between 22:00 hours and 8:00 hours were considered night-time. The following complications were recorded in the acute phase: ventricular fibrillation, complete atrioventricular block, atrial fibrillation and heart failure (Killip grade ≥ II). The definition of shock during the first attendance was based on the clinical judgment of the treating physician of the case. All-cause mortality was determined at one month and one year of evolution. Data on clinical follow-up were obtained centrally from the Catalan Department of Health by consulting official mortality registries.

Analysis of factors linked to the organization of hospitals without hemodynamic support EDs

A 4-question questionnaire was provided to the EDs of the 16 HWHSs in the reference region to identify variables that could influence action times[5,7,8] which were subsequently incorporated into the reperfusion circuit database: 1) is a specific physician assigned to provide the first assistance in the event of suspected STEMI? 2) is there a chest pain unit (CPU) in the emergency department; 3) is there an interhospital transfer service base in your center? and 4) is regular monitoring of STEMI response times carried out in your department? The CPU was defined as the space in the emergency department reserved for the care of patients with suspected acute coronary syndrome on arrival at the hospital and the performance and early interpretation of the ECG.

Statistical analysis

In the descriptive analysis, continuous variables were expressed as mean and standard deviation or medians and interquartile range in cases with non-normal distribution; categorical variables were expressed as absolute and relative frequency. In the univariate analysis, the Student t test was used to compare means, the chi-square test to compare dichotomous variables and the nonparametric Mann-Whitney test for comparisons between medians. Multivariate analysis of predictors of elongated FMC was performed by logistic regression. The dependent variable was an FMC greater than 120 minutes and all variables with $p < 0.1$ in the univariate analysis (sex, age, diabetes mellitus, previous infarction, previous coronary surgery, shock on first assist, orotracheal intubation, Killip ≥ II, night-time, left bundle branch block, ST-segment elevation on ECG and availability of CPU) were included in the model. Odds ratios (OR) were calculated for the different variables. In addition, a multiple linear regression analysis was performed in which FMC (continuous variable) was considered as a dependent variable, and variables with $p < 0.1$ in the univariate analysis were included in the model. In addition, predictors of DIDO prolongation (> 60 minutes) were analyzed in 1,684 cases with available data using binary logistic regression. Finally, an analysis of the association between FMC and mortality at 1 month and 1 year was performed using Cox. A value of $p < 0.05$ was considered statistically significant. Statistical analyses were performed using SPSS 18 (SPSS, Inc.; Chicago, Illinois, United States).

Results

Between January 2010 and December 2016, 23,507 circuit activations took place in Catalonia, of which 18,781 (80%) corresponded to the health region studied. There was a 4% reduction in the number of activations performed in a HWHS and a 7% increase by EMS throughout the study period ($p < 0.001$) (Figure 1).

Among the patients initially treated in HWHS, 3,437 activations corresponded to the health region studied and were residents of Catalonia. A total of 2,592 patients underwent PCI, which constitutes the study population (Figure 2). The final analysis was performed in 2,542 cases, as we did not have all the data for 50 of them. The mean age of the population was 63 ± 13 years (13% > 80 years); 77% were male. The median FMC was 130 (105-175) minutes and the time was ≤ 120 minutes in 42% of the cases, which had a median of 101 (90-112) minutes. A non-significant trend of decreasing FMC was appreciated during the study (from 130 minutes in 2010 to 123 minutes in 2016, $p = 0.18$). When analyzing the distribution by quartiles of observed FMC, an increase in the percentage of cases with FMC ≤ 130 minutes was appreciated (from 49% in 2010 to 57% in 2016, $p < 0.001$).

Table 1 shows the characteristics of the population as a function of FMC. The FMC-ECG, FMC-CA and DIDO intervals were significantly different (Figure 3),

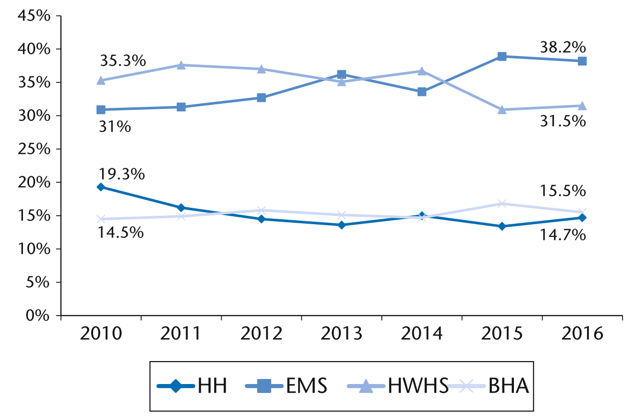

Figure 1. Frequency of activations according to whether the first care was provided in a basic health area (BHA), hospital without hemodynamics (HWHS), out-of-hospital emergency medical system (EMS) or hospital with hemodynamics (HH).

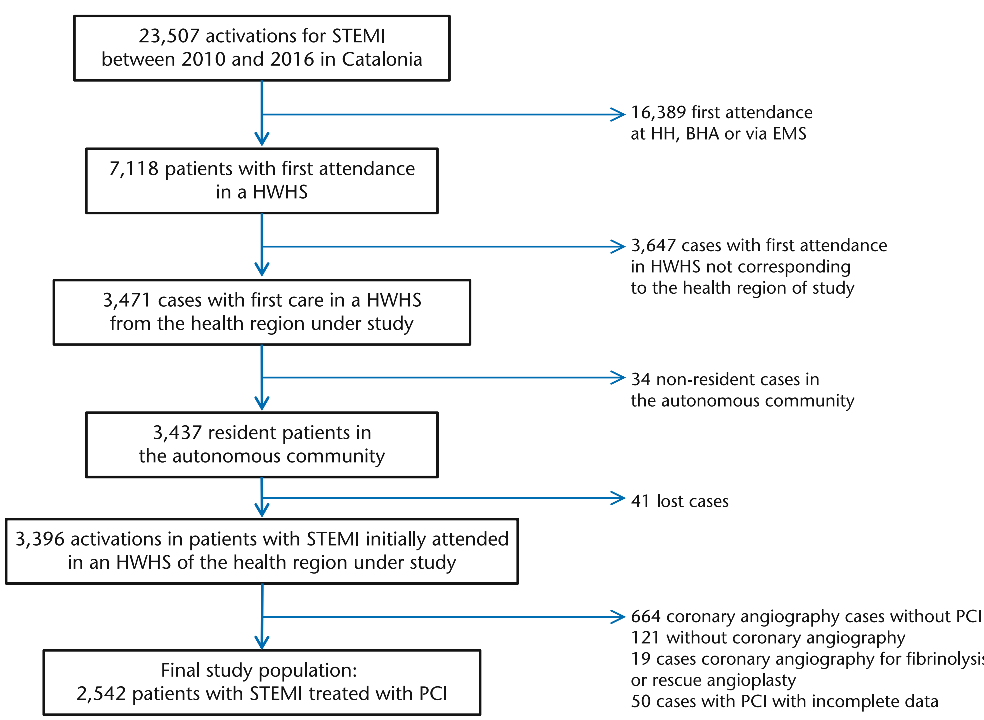

Figure 2. Patient flow diagram.
BHA: basic health area; HH: hospitals with hemodynamics; HWHS: hospitals without hemodynamics; ST-STEMI: segment elevation myocardial infarction; PCI: percutaneous coronary intervention; EMS: emergency medical system; PCI: percutaneous coronary intervention.

Table 1. Main characteristics of the study population and differences according to the time from the first medical contact to reperfusion

Variables	Global N = 2,542 n (%)	FMC ≤ 120 minuts N = 1,071 n (%)	TPA > 120 minuts N = 1,471 n (%)	p
Male sex	1,956 (77)	860 (80.3)	1,096 (74.5)	< 0.001
Age [mean (SD)]	63 (13)	61 (13)	64 (14)	< 0.001
Age ≥ 80 years	331 (13)	89 (8.3)	242 (16.4)	< 0.001
Smoking*	227 (32)	114 (36)	113 (28)	0.035
Diabetes mellitus	556 (21.8)	207 (19)	349 (24)	0.009
Arterial hypertension*	304 (42)	130 (41)	174 (44)	0.494
Dyslipidemia*	265 (37)	133 (42)	132 (33)	0.018
Cerebrovascular disease*	12 (1.7)	7 (2.2)	5 (1.25)	0.486
Previous myocardial infarction	229 (9)	84 (7.8)	145 (10)	0.092
Prior percutaneous coronary intervention	159 (7)	64 (6.6)	95 (7.4)	0.507
Previous coronary surgery	29 (1.1)	8 (0.7)	21 (1.4)	0.078
Initial ST-segment elevation ECG	2,334 (93.4)	1,044 (98)	1,290 (89)	< 0.001
Initial non-diagnostic ECG	102 (4.1)	3 (0.3)	99 (6.9)	< 0.001
LBBB	23 (0.9)	4 (0.4)	19 (1.3)	< 0.001
Killip I	2,153 (86)	948 (89.4)	1,205 (83.2)	< 0.001
Killip II	196 (7.8)	75 (7.1)	121 (8.4)	< 0.001
Killip III	59 (2.2)	13 (1.2)	46 (3.2)	< 0.001
Killip IV	100 (4)	24 (2.3)	76 (5.2)	< 0.001
Orotracheal intubation	61 (2.4)	8 (0.7)	53 (3.6)	< 0.001
Shock in first aid	65 (2.6)	11 (1.0)	64 (3.7)	< 0.001
Ventricular fibrillation	114 (4.5)	44 (4.1)	70 (4.7)	0.497
Complete atrioventricular block	132 (5.2)	54 (5)	78 (5.3)	0.787
Night shift**	973 (38)	385 (36)	588 (40)	0.043
Chest pain unit	1,714 (67)	769 (72)	945 (64)	< 0.0001
Periodic analysis of results	1,381 (54)	572 (53.4)	809 (55)	0.444
Own EMS database	1,653 (65)	703 (65.5)	950 (64.5)	0.584
Pain onset time-first assistance (min) [median (IQR)]	94 (49-200)	85 (45-164)	106 (54-230)	< 0.001
Time first assistance-ECG (min) [median (IQR)]	10 (5-18)	9 (5-14)	13 (6-16)	< 0.001
First-attendance-activation time (min) [median (IQR)]	31 (18-10)	19 (13-28)	58 (32-105)	< 0.001
DIDO*** (door-in to door-out) (min) [median (IQR)]	72 (54-103)	54 (45-64)	100 (79-150)	< 0.001
First medical contact to reperfusion time (min) [median (IQR)]	130 (105-175)	101 (90-112)	164 (137-225)	< 0.001
Total ischemia time (min) [median (IQR)]	245 (173-380)	180 (137-264)	301 (215-465)	< 0.001
Mortality at 1 month	110 (4.3)	23 (2.1)	87 (5.9)	< 0.001
Mortality at 1 year	190 (7.5)	46 (4.3)	144 (9.8)	< 0.001

*Only available in 714 patients. Killip grade is available in 2,503 patients.
**From 22:00 to 8:00 hours. Median time intervals are expressed in minutes.
***Available in 1,684 patients.
ECG: electrocardiogram; LBBB: left bundle branch block; EMS: out-of-hospital emergency medical system; FMC: first medical contact, SD: standard deviation.

with medians of 9 (5-14), 19 (13-28) and 54 (50-64) minutes respectively for patients with a FMC ≤ 120 minutes and 13 (6-16), 58 (32-105) and 100 (79-150) minutes for patients with a FMC greater than 120 minutes ($p < 0.001$).

Factors associated with the organization of the ED and impact on response times

In 9 of the 16 HWHS, there was a CPU and in 7 of the 16, the recorded action times were analyzed periodically. In all cases, the first care was provided by a physician assigned by the ED and half of them had their own base in the interhospital transport system. Periodic monitoring of times and the presence of their own base were not associated with a FMC ≤ 120 minutes. However, the availability of a CPU was associated with shorter times, as the percentage of patients attended in centers with CPU was higher within the FMC ≤ 120 minutes group (72% vs 64%, $p < 0.001$) (Table 1). This variable behaved as an independent predictor of FMC ≤ 120 minutes in both logistic regression analysis [OR 0.64 (95% CI 0.54-0.77), $p < 0.001$] and linear regression analysis, with a reduction of 11 minutes in FMC in patients attended in hospitals with CPU (95% CI 20.2-2.1, $p = 0.016$). The rest of the variables associated with an FMC greater than 120 minutes in both analyses are shown in Table 2 and Table 3, respectively.

The variables associated with a prolongation of DIDO were age, female sex, intubation at first assistance, nighttime care, as well as the lack of availability of CPU or EMS own base (Table 5).

Prognostic impact of delays on performance times

Valid follow-up data were obtained in all patients and overall mortality at 1 month and 1 year was 2.1% and 4.3%, respectively. This was significantly related to

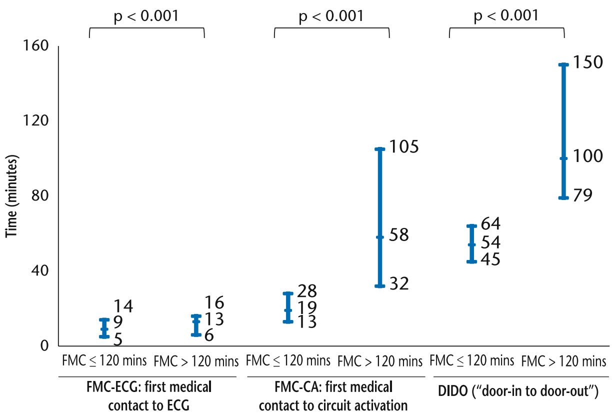

Figure 3. Distribution of first-contact-to-ECG (FMC-ECG), first-contact-to-activation (FMC-CA) and door-in-to-door-out (DIDO) time intervals as a function of first-medical-contact-to-reperfusion (FMC) time. Lines and dots represent medians and 25th and 75th percentiles.

greater delay to reperfusion, and was 7.3% and 12.4% in cases with an FMC ≥ 176 minutes (Figure 4). This association maintained its statistical significance in the adjusted analysis (p = 0.010; Table 5).

Discussion

In patients with STEMI who initially consulted a HWHS, a FMC within the recommendations was achieved in only 42% of them. A CPU was available in 9 of the 16 HWHSs, half of the centers had their own EMS database, and in 7 of them the time to treatment was monitored periodically. The availability of CPU was an independent predictor of FMC ≤ 120 minutes. Mortality at 1 month and 1 year increased proportionally to the delay until reperfusion.

The data from this large series of consecutive and unselected patients initially attended at HWHS corroborate the delays in reperfusion times previously published in this clinical scenario[2,3,9-11]. Part of this delay is attributable to the requirement for interhospital transfer, conditioned by geographic and even meteorological aspects[3] that are difficult to modify. However, the area studied in this study is urban, with a high population density (covering two thirds of the population of Catalonia), a fairly homogeneous geography and a relatively short distance between hospitals. Therefore, interhospital transfers within this area should reasonably allow reperfusion times to be adapted to the recommendations.

Delay to reperfusion was associated with parameters related to the diagnostic and activation phase. The median FMC-ECG and FMC-CA times in those cases with a FMC ≤ 120 minutes were in accordance with the recommended limits[1,12,13] whereas in the group with a FMC greater than 120 minutes there was a greater degree of dispersion. Most patients presented DIDO values above the recommended values[14-16].

On the other hand, the most original aspect of this study is the analysis of factors related to the structure of the ED, since relevant aspects of this structure showed important differences between the centers analyzed. Slightly more than half of the centers had a CPU, while in 44% there was periodic monitoring of action times and half of the centers had a stable base of the EMS.

The availability of CPU was associated with an 11-minute reduction in final FMC. The CPU allows pa-

Table 3. Variables associated with a first medical contact-to-reperfusion (FMC) greater than 120 minutes in the multiple linear regression analysis

Variable	B Coefficient (95% CI)	p
Age	0.35 (0.03 a 0.68)	0.03
Female sex	6.42 (–3.43 a 16.28)	0.20
Diabetes mellitus	9.90 (0.11 a 19.69)	0.048
Previous myocardial infarction	6.81 (–7.37 a 21.01)	0.34
Previous coronary surgery	9.29 (–28.5 a 47.09)	0.63
Orotracheal intubation	0.52 (–27.5 a 28.61)	0.97
Shock in first assistance	16.61 (–11.73 a 44.96)	0.25
Killip ≥ II	12.08 (–0.37 a 24.53)	0.057
Nocturnal schedule	6.35 (–1.83 a 14.53)	0.128
BRIHH	23.95 (–17.80 a 65.71)	0.26
Chest pain unit	–11.16 (–20.21 a –2.12)	0.016

Values are shown as coefficients.
95% CI: 95% confidence interval; LBBB: left bundle branch block.

Table 2. Variables associated with a first medical contact-to-reperfusion time (FMC-R) greater than 120 minutes in univariate and multivariate logistic regression analysis

Variable	Univariate analysis			Multivariate analysis	
	FMC ≤ 120 minutes	FMC > 120 minutes	p	OR (95% CI)	p
Female sex	19.7%	25.5%	< 0.001	1.25 (1.01-1.52)	0.04
Age [mean (SD)]	62 (13)	64 (14)	< 0.001	1.01 (1.01-1.02)	< 0.001
Diabetes mellitus	19%	24%	0.009	1.13 (0.92-1.39)	0.24
Previous infarction	7.8%	10%	0.092	1.27 (0.95-1.70)	0.11
Previous coronary surgery	0.74%	1.4%	0.078	1.60 (0.68-3.79)	0.28
Shock on first attendance	1.02%	3.7%	< 0.001	2.15 (1.05-4.38)	0.04
Thorotracheal intubation	0.75%	3.6%	< 0.001	3.82 (1.74-8.35)	< 0.001
Killip ≥ II	10.6%	16.8%	< 0.001	1.29 (0.99-1.67)	0.062
Night shift	36%	40%	0.043	1.22 (1.04-1.45)	0.02
LBBB	0.4%	1.32%	< 0.001	2.76 (0.92-8.26)	0.069
ST segment elevation	99%	89%	< 0.001	0.10 (0.05-0.19)	< 0.001
Chest pain unit	72%	64%	< 0.001	0.64 (0.54-0.77)	< 0.001

Values express percentage or mean ± standard deviation. 95% CI: 95% confidence interval; LBBB: left bundle branch block; OR: odds ratio.

Table 4. Variables associated with a DIDO (door-in to door-out) greater than 60 minutes in the multivariate analysis

	OR (95% CI)	p
Age	1.01 (1.01-1.02)	0.002
Female sex	1.45 (1.11-1.90)	0.006
Diabetes mellitus	1.26 (0.97-1.65)	0.086
Previous myocardial infarction	1.02 (0.69-1.49)	0.915
Previous coronary surgery	2.75 (0.77-9.9)	0.12
Orotracheal intubation	2.92 (1.05-8.09)	0.039
Shock in first assistance	2.01 (0.71-5.71)	0.19
Killip ≥ II	1.29 (0.91-1.83)	0.15
Night shift	1.28 (1.03-1.59)	0.025
LBBB	1.94 (0.40-9.43)	0.41
Chest pain unit	0.73 (0.57-0.94)	0.015
Own EMS base	0.58 (0.45-0.75)	< 0.001

LBBB: left bundle branch block; EMS: out-of-hospital emergency medical; 95% CI: 95% confidence interval; OR: odds ratio.

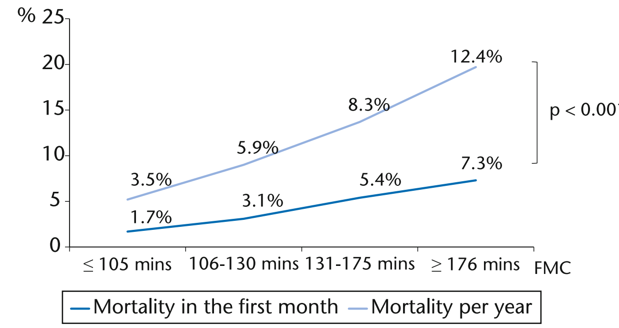

Figure 4. Overall mortality at one month and one year of evolution as a function of the quartiles of the time from first medical contact to reperfusion.

tients with suspected acute coronary syndrome to be attended preferentially, the first ECG to be performed rapidly, and the decision to activate or not the reperfusion circuit to be made. The benefit of chest pain units (CPU) in shortening the diagnostic delay and speeding up reperfusion therapy has been studied in the HH[7,24-26] but, to our knowledge, this is the first study to demonstrate the benefit of using a CPU in patients initially attended in a HWHS. Its availability in HWHS seems reasonably feasible, without requiring a CPU as such (its only requirements are an electrocardiograph, a defibrillator, a stock of drugs frequently used in this context, and the possibility of monitoring until transfer), and given the results of this study it could be considered a highly recommendable measure in this scenario, characterized by a marked delay in the time to reperfusion.

No other factor related to the organization of the ED was associated with the duration of the FMC. Neither the periodic monitoring of response times nor the presence of an ambulance in the center itself was associated with shorter FMC. In the first case, because this measure alone does not guarantee a shortening of times if it is not accompanied by other improvement initiatives[8]; in the second, because ambulances work in a territory attending the emergencies of the population and are not only linked to the activity of the hospital where they are based.

The variables independently associated with FMC longer than 120 minutes were age, female sex, night-time care, shock on first attendance, need for orotracheal intubation, and, to a lesser extent, LBBB (left bundle branch block) and Killip grade ≥ II, data consistent with previous studies. Older patients have a greater number of comorbidities[17] atypical symptoms[18] and complications in the acute phase[17,18] which can lead to longer delays in requesting assistance[19] and reperfusion[17]. The delay until PCI in women[19,20] may also be related to the atypical nature of the symptoms[21] (although most present with typical pain), as well as older age and complications in the acute phase[20] and even a lower perceived pretest probability of heart disease when interpreting the ECG on occasions[21]. First attendance at night was associated with a 20% increase in the risk of achieving a FMC greater than 120 minutes. This may be due both to the variability in the definitions used[2,12,14] and to a possible lower number of personnel and resources during the night-time hours in HWHS compared to HH. Regarding LBBB, its presence can delay diagnosis in cases in which its preexistence is suspected and, on the other hand, it is associated with a higher prevalence of structural heart disease, with a greater risk of complications and delayed reperfusion[22,27]. Finally, complications in the acute phase are an important predictor of delayed reperfusion. The need to preserve the airway in acute pulmonary edema or to initiate vasoactive amines inevitably delays arrival at the catheterization laboratory, and the time required to stabilize a patient before transfer is unpredictable. Similar data have recently been reported[28]. In our series, 14% of cases presented heart failure in the acute phase.

Table 5. Variables associated with mortality at one month and one year in the multivariate analysis

	Mortality in the first month		Mortality per year	
	OR (95% CI)	p	OR (95% CI)	p
Time from first medical contact to reperfusion	1.84 (1.09-3.09)	0.02	1.65 (1.13-2.42)	0.01
Age	1.097 (1.07-1.12)	< 0.001	1.093 (1.07-1.11)	< 0.001
Female sex	0.88 (0.54-1.42)	0.6	0.99 (0.69-1.44)	0.73
Diabetes mellitus	1.09 (0.68-1.73)	0.73	1.07 (0.74-1.54)	0.73
Previous myocardial infarction	0.99 (0.51-1.93)	0.99	1.33 (0.80-2.20)	0.27
Previous coronary surgery	0.34 (0.036-3.28)	0.35	1.26 (0.34-4.64)	0.73
Orotracheal intubation	1.37 (0.52-3.61)	0.52	1.45 (0.62-3.39)	0.38
Shock in first assistance	4.48 (2.16-9.29)	< 0.001	3.13 (1.58-6.22)	0.001
Killip ≥ II	6.01 (3.77-9.59)	< 0.001	4.33 (2.99-6.28)	< 0.001

CI 95%: 95% confidence interval; OR: odds ratio.

It is also worth mentioning the important prognostic implications of delayed reperfusion observed in this series, since mortality at 1 month and 1 year in patients with a FMC ≥ 176 minutes was almost four times higher than in those with an FMC < 106 minutes.

The results of this study suggest, firstly, maintaining practices such as the use of PCI by a single physician, preferably in the emergency department[4,8] and guaranteeing the continuous training of health care personnel. Secondly, based on the results shown, the existence of a CPU or a device of similar characteristics should be recommended in the emergency area of all HWHS which can attend this type of patient. Finally, population education campaigns should be maintained, and it should be recommended that in the presence of chest pain the patient should call directly to an assigned telephone number so that the EMS can provide first aid and transfer the patient directly to the HH, as indicated in current guidelines[1]. In this regard, the data from this study show a slight increase in recent years in the number of EMS activations.

This study has several limitations. Firstly, the analysis corresponds only to the time dedicated to diagnosis, in a series of patients attended in one health region, so the results may not be extrapolable to other territories with different geography. Previous studies have documented that, if the orography is homogeneous and the transfer time can be predicted, the time that most affects the FMC is the time spent in diagnosis[3]. Secondly, only patients resident in the autonomous community (Catalonia) were included in order to obtain mortality at 1 month and 1 year, excluding those who did not undergo PCI. This could lead to a selection bias, although the analysis included all cases in which consecutive PCI was performed during the established time period, and the results are superimposable to other series[10,23]. Finally, as in other similar studies[23], potential confounding factors that were not analyzed, such as previously administered antithrombotic medication or structural differences between centers with and without CPU, may have been underestimated. However, the results are consistent with previous studies[2,9,13,15,19,23] and, therefore, provide reliable information regarding the routine care of these patients.

Conflicting interest: The authors declare no conflict of interest in relation to the present study.

Financing: This study was funded by the Codi Infart program of the Pla director de malalties de l'aparellcirculatori (Departament de Salut, Generalitat de Catalunya).

Ethical responsibilities: All authors have confirmed the maintenance of confidentiality and respect for patients' rights in the author's responsibilities document, publication agreement and assignment of rights to EMERGENCIAS.

Article not commissioned by the Editorial Board and with external peer review.

Acknowledgments: To the staff who collaborate with the Codi Infart program, for their effort and involvement which allows the improvement of care in the daily practice of these patients. To Carme Carré, for her collaboration in the analysis. To the emergency departments of the HWHS consulted, who responded diligently to the questions and thus contributed to improving the care of these patients.

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