


## Comprehensive action in patients with ST-segment elevation acute coronary syndrome: Ten years of the Infarction Code in Catalonia

### *Actuación integral en el paciente con síndrome coronario agudo con elevación del segmento ST: 10 años de Código Infarto en Cataluña*

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#### To the Editor,

Emergency and urgency care has always required prioritizing the severity of the patients. Hospital urgency services have traditionally organized patient care based on indicators established for centers with similar levels of complexity. This inefficient form generates delays in their care with the inconveniences that this causes, especially in the identification of serious situations, which can exceed 20% of the reasons for consultation<sup>1</sup>.


Time-dependent conditions, such as coronary heart disease, require a high level of organization among the different actors participating in the care process, since its prognosis depends on the speed of diagnosis suspicion and the start of treatment<sup>2</sup>, as well as a clear definition of the disease's inclusion criteria to be analyzed in order to avoid inclusion biases, a fundamental element to know what we are dealing with<sup>3</sup>.

In Catalonia, which represents 18% of the Spanish

population, the need to establish measures to improve the care of a specific type of patient within coronary heart disease, STEMI (ST-segment elevation acute myocardial infarction [AMI]) was raised, mainly due to higher mortality rates in the acute phase and the appearance, in its day, of new reperfusion strategies such as primary angioplasty (PA). It was decided to name it as the "Infarction Code", and it was not until 2009 that it could be implemented in the entire territory to respond to the 7.5 million inhabitants that this community currently has.

After ten years of the project's implementation, we would like to share the main results, as well as expose the difficulties that both, its start and its upkeep, require over time. This type of strategy requires a high degree of effort to maintain a level of relationship and cooperation between levels of care, a fact that allows establishing bonds of trust that multiply the effects of the procedure. Ultimately, it was decided to put into practice the theoretical concepts of coordination and teamwork, which includes the alert received in the emergency call center<sup>4</sup>, the basic and advanced emergency teams themselves, the health center of the community and hospitals. All this endorsed and coordinated by the health authority, the Department of Health.

The fundamental aspects and the strategy for the development of the project can be summarized in

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the following points. Broadly speaking, this program is based on a series of premises:

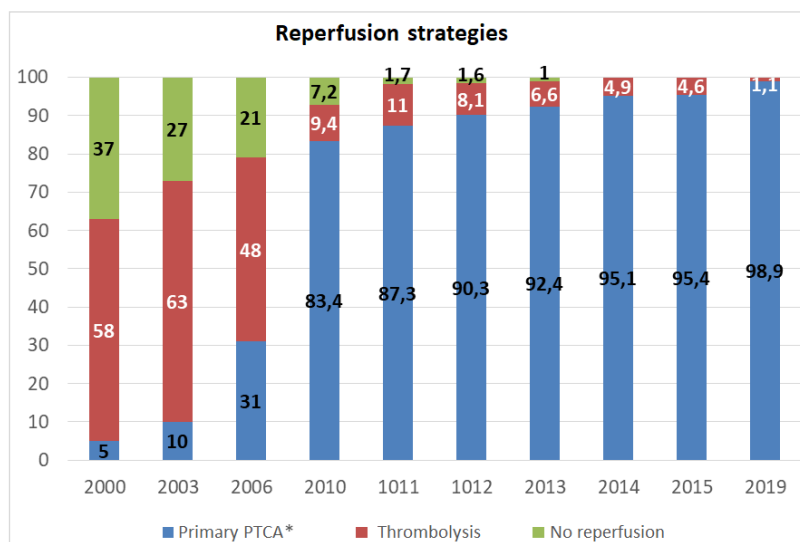
- Change in the decision center: the witness is passed from the cardiologist to the doctor of the Department of Medical Emergency (SEM, after its abbreviation in Spanish) or the doctor who makes the first medical contact.
- Sectorization of the territory that uniquely defines a predetermined destination for each patient, depending on the place where the infarction occurred.
- Mandatory acceptance of the case by the referral hospital (there are ten in Catalonia).
- Obligation to return the treated and stabilized patient to the center of origin or to the intensive/intermediate care unit closest to the patient's home, to avoid overloading the referral hospital.
- Obligation to declare the cases of activation of the "Infarction Code" by the referral centers.
- Continuous evaluation: it is a stimulus for the improvement of the results and for the detection of the system's inefficiency pockets in order to take corrective measures and plan the assistance.

Since January 1, 2010, more than 30,000 patients have been registered with the initial suspicion of STEMI. In the last three years (2017-2019), about 4100 "Infarction Codes" were activated annually, which corresponds to the prevalence of the disease; of these, 75% are men, the majority between 45 and 70 years old, without neglecting the percentage of AMI in the elderly, an element that deserves in-depth and specific discussion<sup>5,6</sup>, as well as the increased incidence in young people associated with drug abuse<sup>7</sup>. Out of the total number of Codes activated in 2019, the STEMI was confirmed in 79.4%, 3.5% were AMI without ST-segment elevation, in 1.1% the initial suspicion was involvement of the common trunk, 0.7% posterior AMI, 0.6% was accompanied by right bundle branch block, these last three cases do not initially present with ST-segment elevation, although since 2017, they have been considered analogous cases and have been referred to a hemodynamic laboratory. A 4.7% were considered unclassifiable acute coronary syndromes and 10% of the cases still remain among those who did not have

criteria for activating the code (7.1%), or there was not enough information in the registry to be analyzed (2.9%).

The time that elapses from the completion of the electrocardiogram to the opening of the artery has been reduced in recent years, from a median of 110 minutes in 2010 to 93 in 2019. From the time the electrocardiogram was performed, the procedure to open the artery responsible for the infarction was performed in less than 120 minutes, in 72.5% of the patients; we are aware that the challenge consists in progressively increasing the number of patients to be included in this range.

In some published registry series, clinical false positives reached 11.6%, thus, their identification and analysis represented a challenge to improve patient care. Female gender, left bundle branch block, and a history of myocardial infarction are independent factors that were associated with a higher number of false positives. Left bundle branch block, as a widely accepted inclusion criterion, should perhaps be revised due to the high number of false positives it generates<sup>8</sup>. Likewise, a higher rate of false positives was found in hospitals without on-site cardiac catheterization facilities and in patients with complications during the first medical contact<sup>9</sup>. These figures support the commitment and good work of prehospital teams, both emergency (SEM) and primary health care teams.



**Figure 1.** Evolution of the reperfusion strategies in STEMI since 2000, in Catalonia. The Infarction Code was implemented in January 2010.

\* Primary angioplasty and cardiac catheterization performed in the acute phase are included. PTCA, percutaneous transluminal coronary angioplasty. January 1, 2010, official start of the Infarction Code project in Catalonia.

Regarding the initial severity of the patients, 75% were classified as Killip I, while 8% had a Killip IV at presentation. Only 1.1% of the patients received fibrinolytic treatment, 78.8% of the activated cases underwent PA, and 19.6% underwent coronary angiography without angioplasty. The final diagnosis was AMI in 79%, unstable angina in 1.1% and the rest were grouped into different diagnoses. The most severe patients required more invasive therapeutic strategies: intra-aortic balloon counterpulsation (2.7%), Impella (0.4%) and 0.3% required extracorporeal membrane oxygenator (ECMO) support.

Other interesting data are those derived from the analysis of cases that presented sudden death, which, once recovered by the emergency teams (SEM), are included as "Infarction Code", provided that the electrocardiogram shows criteria for a referral to the hemodynamics room. In these patients, the presence of primary ventricular fibrillation has been a predictor of mortality at one year<sup>10</sup>.

In short, this is a consolidated project that has required multiple coordination efforts and commitment, and it has offered the same treatment opportunities to all patients with STEMI. We have managed to offer primary angioplasty to more than 95% of patients, and to reduce to a minimum the number of patients who do not receive treatment (Figure 1). On the other hand, the advantage of the involve-

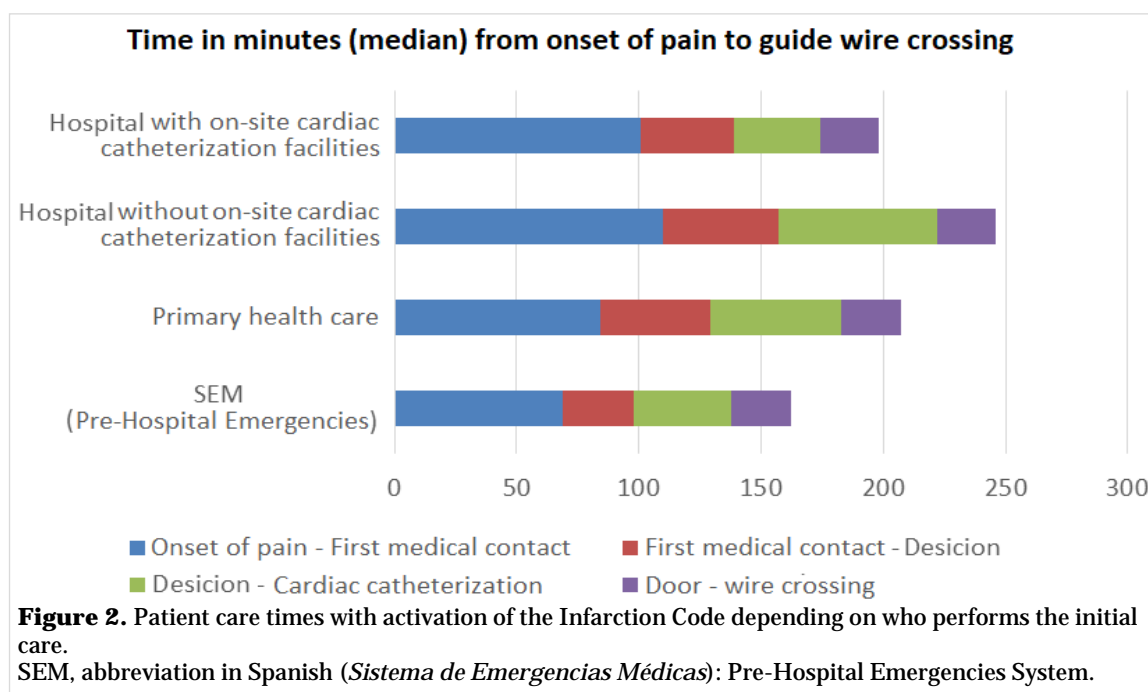
ment of prehospital emergency teams in projects of these characteristics has been demonstrated; they have the shortest overall process times, even more so than if the patient comes to the hospital center by his or her own means (Figure 2).

## CONFLICT OF INTERESTS

None declared.

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