Applicability of a New Definition of Myocardial Infarction and the Opinion of Spanish Cardiologists

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Introduction and objectives. The Working Group on Ischemic Heart Disease and Coronary Care Units of the Spanish Society of Cardiology evaluated the applicability of a new definition of infarction in Spanish hospitals, its current use, and the opinion of Spanish cardiologists.

Methods. A telephone survey was made (from late 2001 to early 2002) in Spanish hospitals to evaluate the availability of troponin or creatine kinase MB mass determinations. A questionnaire was sent to all members of the Spanish Society of Cardiology to query about the availability of determinations of cardiac necrosis markers at their respective hospitals, use of the new definition, and whether they agreed with the new definition.

Results. An important proportion of Spanish hospitals cannot determine myocardial necrosis markers (troponin or creatine kinase MB mass), mainly due to low-volume activity (fewer than 200 beds). The new definition of myocardial infarction was used by Spanish cardiologists always (24%), frequently (31%), sometimes (17%), seldom (14%), and never (11%). Agreement with the definition was complete in 21%, almost complete in 33%, half and half in 26%, rare in 10%, and absent in 7% of Spanish cardiologists.

Conclusions. A large percentage of Spanish hospitals cannot use the new definition of myocardial infarction because they cannot determine specific cardiac necrosis markers. Spanish cardiologists are not generally using the new definition and many do not agree with it.

Key words: *Myocardial infarction. Diagnosis. Troponin.*

Aplicabilidad de la nueva definición de infarto de miocardio y opinión de los cardiólogos españoles

Introducción y objetivos. La Sección de Cardiopatía Isquémica y Unidades Coronarias de la Sociedad Española de Cardiología ha querido conocer la posibilidad de aplicar la nueva definición de infarto en hospitales españoles, la amplitud de su uso y la opinión que tienen los cardiólogos españoles.

Métodos. Se realizó una encuesta telefónica (finales de 2001-principios de 2002) a hospitales españoles para conocer la posibilidad de determinar la troponina T, I o creatincinasa MB masa. Se envió una encuesta simple a todos los cardiólogos de la Sociedad Española de Cardiología preguntando por la disponibilidad de marcadores de necrosis miocárdica en sus respectivos hospitales, el grado de utilización de la nueva definición de infarto y su nivel de acuerdo con la nueva definición.

Resultados. Una proporción importante de hospitales españoles (336 de 626; 53%) no dispone de marcadores de necrosis miocárdica (troponinas o creatincinasa MB masa), siendo esta proporción sobre todo a expensas de hospitales de menor tamaño (de menos de 200 camas). Los cardiólogos españoles (n = 269) utilizan sólo sistemática (24%) o frecuentemente (31%) la nueva definición de infarto, mientras que el 17% la emplea a veces; el 14%, raramente, y el 11%, nunca.

Conclusiones. Un gran porcentaje de hospitales españoles no está en disposición de aplicar la nueva definición de infarto de miocardio, ya que no dispone de marcadores específicos (troponinas o creatincinasa MB masa) de necrosis miocárdica. La aplicación de la nueva definición de infarto entre cardiólogos españoles no está generalizada. Muchos cardiólogos españoles están en desacuerdo con la nueva definición de infarto.

Palabras clave: *Infarto de miocardio. Diagnóstico. Troponina.*

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INTRODUCTION

In September, 2000, a consensus document of the European Society of Cardiology (ESC) and the American College of Cardiology was published on the new definition of myocardial infarct.[1] A myocardial infarct is still defined as being present when there is a proven rapid elevation and gradual decrease (via

This study was performed by the Sección de Cardiopatía Isquémica y Unidades Coronarias de la Sociedad Española de Cardiología.

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ABREVIATIONS

CK-MB: MB creatinkinase.
SCI and UC: Sección de Cardiopatía Isquémica y Unidades Coronarias (Section of Ischemic Cardiopathy and Coronary Care Units).
SEC: Sociedad Española de Cardiologia (Spanish Society of Cardiology).
ESC: European Society of Cardiology.

troponin measurement) or a rapid increase and decrease (creatinkinase MB [CK-MB] measurement) in markers of myocardial necrosis in the context of symptoms indicative of myocardial ischemia, electrocardiographic changes indicative of ischemia, or coronary intervention.

Since the publication of this consensus, various opinions have been published in the literature in favor[2,3] and against[4,5] this new definition. It has been said that the new definition supposes «troponization» of the diagnosis of an infarct,[6] as its measurement is necessary for the diagnosis. In Spain it is not known if it is possible to apply the new definition in various hospitals, as the means to measure troponin T (TnT) or troponin I (TnI) or CK-MB mass must be available in order to apply it. In addition, the rate of use of the new definition among cardiologist is unknown; nor is it known how the new definition is viewed.

La Sección de Cardiopatía Isquémica y Unidades Coronarias (SCI and UC) (Section of Ischemic Cardiopathy and Coronary Care Units) of the Sociedad Española de Cardiologia (SEC) (Spanish Society of Cardiology) is aware of the high level of controversy that the new definition of infarct has caused and wished to evaluate, on one hand, the viability of applying the new definition of infarct in various hospitals in Spain, and on the other hand, determining the frequency of use of the definition and the varying opinions of Spanish cardiologists on the topic according to the results of a survey.

METHODS

Hospital surveys

During the months from July, 2001, to March, 2002, we performed a telephone survey of hospitals in Spain (public and private) with varying levels of activity, and asked about the the availability of resources for measuring TnT, TnI, or CK-MB mass. Initially, we contacted a cardiologist, when one was available in the hospital, or an emergency medicine physician. In a sample of 170 hospitals, we directly contacted the head of the main laboratory or a physician on the laboratory service. This specific survey asked those responsible for clinical analysis to consider whether the clinicians who responded to the survey were not sure of the type of troponin that was tested for in their hospital (TnT or TnI) or had doubts regarding the analytical method used to determine CK-MB (mass or enzyme activity).

Cardiologist surveys

During the lasts 4 months of 2001 we sent a survey (by e-mail or regular mail) to all members of the SEC to determine 3 things: *a)* the availability of TnT, TnI, and CK-MB mass testing in their hospital; *b)* the frequency of use of the new definition of infarct in their hospital which could be categorized 5 ways: never, rarely, sometimes, frequently, and always, and *c)* the degree of agreement with the new definition of an infarct, which was categorized on 5 levels: completely, substantially, partially, very little, and not at all. In addition, space was provided for the cardiologist to elaborate on the reasons for their opinion.

RESULTS

Telephone survey to hospitals

We obtained data on the determination of markers for myocardial necrosis in 626 Spanish hospitals. The distribution of hospitals by autonomous communities, the level of activity, and the possibility of measuring any of the markers for myocardial necrosis (troponins

TABLE 1. **Availability of markers of necrosis (troponins or CK-MB) in different hospitals by autonomous communities**

	Hospitals surveyed	Markers
Andalusia	79	38 (48%)
Aragon	21	8 (38%)
Asturias	15	7 (46%)
The Balearic Islands	19	14 (73%)
The Canary Islands	41	19 (46%)
Cantabria	7	5 (71%)
Castile and Leon	41	19 (46%)
Castile-La Mancha	23	8 (34%)
Catalonia	142	59 (41%)
Ceuta and Melilla	4	2 (50%)
Extremadura	15	7 (46%)
Galicia	43	18 (41%)
La Rioja	4	1 (25%)
Madrid	53	30 (56%)
Murcia	19	9 (47%)
Navarre	10	7 (70%)
The Basque Countries	42	14 (33%)
Valencia	48	25 (52%)
Total	626	290 (46%)

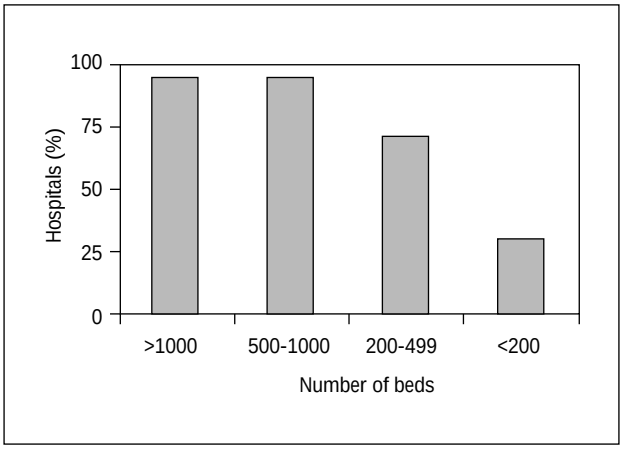

Fig. 1. The availability of any marker for myocardial necrosis (troponin or CK-MB) compared with the number of hospital beds. The hospitals were divided into 4 groups: more than 1000 beds (n=22); between 500 and 1000 beds (n=48); between 200 and 499 beds (n=122), and less than 200 beds (n=434).

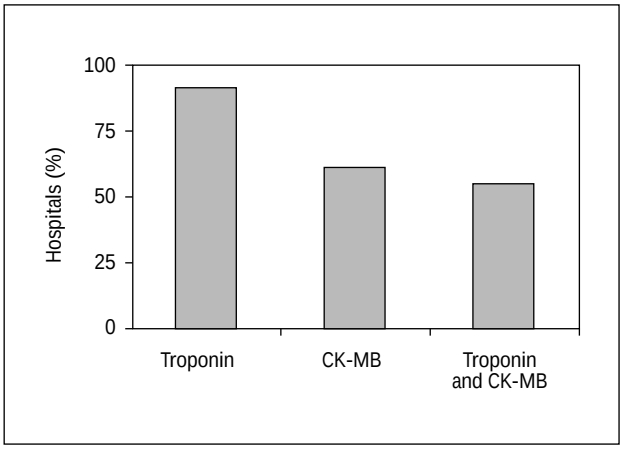

Fig. 2. Type of marker for myocardial necrosis in the 290 hospitals who had troponin (T or I type) or CK-MB testing available. The marker used most often to apply the new definition of infarct is troponin, but more than half the hospitals also had CK-MB testing available.

or CK-MB) are shown in Table 1 and Figure 1.

Of the 290 hospitals with the capacity to detect markers for necrosis, the availability of resources to determine each marker is shown in figure 2. As can be seen, the most generalized marker for myocardial necrosis is troponin, and more than half of the hospitals with markers for necrosis had the capability of determining both troponin values and CK-MB mass. The data from those hospitals with the capacity to measure markers for necrosis was obtained by means of surveys from cardiologists or emergency medicine physicians on 193 occasions and from the physician responsible for the central laboratory in 97 hospitals. The survey sent directly to the central laboratory allowed us to determine precisely what type of troponin was used (39% TnT and 61% TnI). In addition, the availability of CK-MB mass testing according to the cardiologists or emergency department physicians in hospitals that had markers for necrosis was 75% (146 out of 193 hospitals); when the survey was from those responsible for the central laboratory is was 35% (34 out of 97 hospitals).

Mail survey sent to SEC cardiologists

A total of 269 cardiologists from 132 different Spanish hospitals responded to the SCI and UC survey sent by e-mail or regular mail. Eight cardiologists responded in the survey that they did not work in a hospital environment and another 44 stated that they worked in hospitals abroad. Overall, the level of use of the new definition of infarct by Spanish cardiologists is shown in Figure 3, and is as follows: always, 25%; frequently, 32%; sometimes 18%; rarely 14%; and never, 11%. The overall opinion of Spanish cardiologists regarding the new definition of infarct is

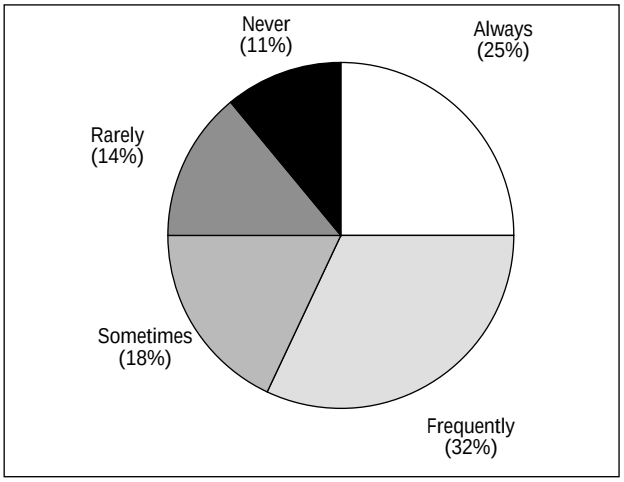

Fig. 3. Degree of overall utilization of the new definition of an infarct among Spanish cardiologists (n=269).

shown in Figure 4 and is as follows: completely in agreement, 22%; significantly in agreement, 34%; partially in agreement, 27%; slightly in agreement, 10%; in total disagreement, 7%. The location of the cardiologists and of the hospitals represented by autonomous communities, as well as the level of use of the new definition and their opinion on the same is shown in Table 2. The capability of obtaining any of the markers for necrosis in the hospitals represented by the cardiologists who answered the survey was 93% (TnT in 47%, TnI in 64%, CK-MB mass in 57%, any type of troponin and CK-MB in 39%).

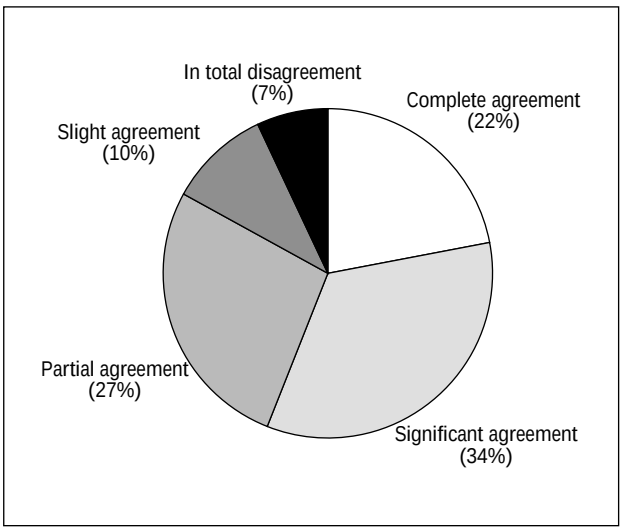

Fig. 4. Overall opinion of the new definition of a myocardial infarct among Spanish cardiologists (n=269).

DISCUSSION

Reasons for a favorable opinion regarding the new definition of an infarct

Our survey indicates that Spanish cardiologists who are completely in agreement or substantially in agreement with the new definition of an infarct think that this definition is much closer to the physiopathology and acute coronary syndrome prognosis,[7-9] unifies the various criteria for an infarct that have been described in the latest studies published in the literature,[2] and allows clear differentiation between the concept of angina (sometimes an empirical term) and an infarct (a more objective diagnosis).[3] In addition, these respondents noted that the new definition of an infarct uses new, early, more sensitive, and more specific markers than the classic markers used for the diagnosis of an infarct, allowing for categorization of risk and better definition of treatment. Finally, by virtue of being a definition arrived at by consensus of the 2 most prestigious scientific institutions, the cardiologists surveyed believed that the new definition should be applied immediately.

Points of conflict with the new definition of an infarct among the cardiologists who substantially or partially accepted the new definition

There were 3 negative considerations cited with regard to the new definition of an infarct that have a clinical, technical, and socioeconomic impact.

TABLE 2. **Degree of use and opinion of cardiologists of the new definition of an infarct according to autonomous communities**

Autonomous communities (number of hospitals)	Cardiologists	Utilization of the new definition		Degree of agreement with the new definition	
		Frequent	Infrequent	Favorable	Unfavorable
Andalusia (17)	26	5	20	9	17
Aragon (3)	7	1	6	2	5
Asturias (7)	9	6	3	5	4
The Balearic Islands (5)	9	4	5	3	6
The Canary Islands (6)	6	5	1	4	1
Cantabria (1)	1	1	0	1	0
Castile-La Mancha (7)	7	1	6	5	2
Castile and Leon (11)	13	7	6	8	5
Catalonia (33)	65	40	25	29	36
Extremadura (6)	10	6	4	7	3
Galicia (14)	19	15	4	13	6
Madrid (18)	36	24	12	22	14
Melilla (1)	1	1	0	1	0
Murcia (2)	4	3	1	3	1
Navarre (4)	6	3	2	3	3
Valencia (12)	23	15	8	14	9
Basque Countries (6)	15	11	4	13	2
Nonhospital cardiologists	8	1	7	1	7
Abroad (4)	4	3	1	3	1
Total (132)	269	152 (56%)	115 (42%)	146 (54%)	122 (45%)

The use of the new definition of infarct was divided into 2 categories: frequent use (always or frequently) and infrequent use (sometimes, rarely, and never). The cardiologists´ opinion regarding the new definition of an infarct was simplified into the categories of favorable (complete agreement or substantial agreement) and unfavorable (partial agreement, slight agreement, complete disagreement). Two cardiologists did not respond to the question regarding utilization and 1 cardiologist did not respond to the question regarding the degree of agreement with the new definition.

From the clinical point of view, it was noted that the use of the new markers for necrosis required by the new definition of an infarct appeared at a time when, in general, there was no previous experience with the use of troponins. The survey responders questioned whether the new definition would be useful for marking decisions in the acute phase of an infarct, at which time electrocardiogram results continue to be the essential criteria, as reflected in the SEC document regarding care of the patient with chest pain;[10] on the other hand, they remarked that the overall prognosis of patients with a diagnosis of an infarct is now even more uniform than previously (the mortality rate for some patients is very low and, in others, is extraordinarily high). Some cardiologists would have been much more comfortable with the diagnosis of «myocardial damage» than «myocardial infarct» in patients with acute coronary syndrome, normal CK-MB, and slightly elevated troponin values, as has been stated by other authors.[11] The responders commented on the importance of the clinical context in which the new definition is used, as an elevation in troponin values has been described in clinical situations that create large diagnostic or terminology-related doubts (for example, slight elevation of troponins in acute pulmonary edema in diabetic patients or a slight elevation of troponins in tachyarrhythmia of a patient who also had chest pain).[12] Some cardiologists believe that the diagnosis of a myocardial infarct by means of documenting an increase in troponin after angioplasty creates confusion and doubt with regard to its association with prognosis, such as has also been noted in the literature.[13-16] They note that the term angina would have to be redefined (for example, the last modification in the Braunwald classificatiion[17] between angina with positive or negative troponin values already does not make sense and the term unstable angina with an increased risk profile is still very restricted). Finally, they opined that the new definition has not been sufficiently disseminated and, by being unknown, is not applied adequately.

From the technical point of view the cardiologists questioned, on the one hand, the cut-off level for troponins for the diagnosis of an infarct, its specificity, and the standardization of the technique. If the new definition of infarct clearly indicates that what is considered to be the cut-off point for an infarct is when the 99th percentile of the troponin or CK-MB value in a control population is surpassed, it is certain that cut-off levels are being applied that define the different methods of analysis (especially when TnI is involved) and that they are, in general, higher than those that are recommended by the new definition. Some scientific societies also have questioned the defined cut-off level because they consider it to be excessively low.[18] There is a certain concern with regard to the possibility of false positive troponin values («troponinosis»),[19] especially in cases of poor concordance that translates into the fact that reality is more complex than simple theory.

In the third place, there are epidemiological considerations (that make the comparison with patients with a classic diagnosis of infarct difficult or impossible) as well as social considerations. It is believed that with the new definition more infarcts will be diagnosed (as has already been seen in published studies[20]), with a negative epidemiological impact. In addition, it is thought that the term «myocardial infarct» has negative work-related, psychological, and probable legal implications.

Reasons for disagreement with the new definition of an infarct

Among many Spanish cardiologists there is disagreement regarding use of the term «infarct» when faced with acute coronary syndrome with a slight troponin elevation because the belief exists that this may, in reality, have to do with ischemia and not a permanent myocardial lesion.[6] In addition, the new definition of an infarct is not accepted because it does not necessarily indicate a bad prognosis (particularly when compared with the prognosis of a «classic infarct») as the social implications that such a diagnosis could carry with it have not been sufficiently evaluated, because it reads as a confused and poorly-defined definition and because it must be used, on many occasions, by physicians who are not cardiologists (emergency room physicians, internal medicine physicians, etc), and, to further complicate matters, many Spanish hospitals do not have the capability of measuring the new markers for myocardial necrosis. For example, at the present time, how to proceed when faced with unstable angina and positive troponin values is clear, but if unstable angina is defined as an infarct, clinical errors and poor interpretation may result. On the other side, we are missing broader studies that compare other diagnostic techniques in order to accept the new definition. Finally, some cardiologists believe that the new definition of an infarct is the result of pressure from the pharmaceutical industry.

Study limitations

We obtained data with regard to the availability of markers for myocardial necrosis for the application of the new definition of a myocardial infarct in almost all Spanish hospitals. This includes public and private medical centers and all types of activity levels. Although it is certain, especially in medical centers with less than 200 beds, that in some centers health care may be limited and very specific; in these types of centers, care for patients with acute coronary

syndromes is not provided regularly, and many of them may need to discard or confirm the diagnosis of a myocardial infarct in a particular patient.

The SEC has more than 2000 members, and 269 members responded to the survey. The response of only 15% of cardiologists is an important study limitation, but is possible that those responding to the survey represented a group of cardiologists with a particular interest in or dedication to ischemic cardiopathy. Of note is the relative lack of knowledge among most cardiologists and clinical technicians regarding the analytical methods used in their hospitals, especially for differentiation of CK-MB by the mass method and by enzyme activity. It is possible that some hospitals identified as disposed to strictly applying the new definition of an infarct would not have been considered if the method of determining CK-MB had actually been that of enzyme activity.

CONCLUSIONS

Our survey revealed that many hospitals in Spain, especially in centers of a relatively small size (less than 200 beds), are not disposed to application of the new definition of a myocardial infarct, as they do not possess the capability of measuring the specific markers (troponin or CK-MB mass) that the new definition requires. The application of the new definition of a myocardial infarct among cardiologists of the SEC is not unanimous: in almost half of the hospitals where they work (and the vast majority of hospitals has necrosis markers available) it is being used in a very limited manner. In addition, only half of Spanish cardiologists are reasonably satisfied with the new definition of an infarct. A higher level of knowledge is required concerning technical and clinical aspects of the diagnosis of a myocardial infarct with the new markers for myocardial necrosis, as well as their diverse applications, in order to achieve a greater level of homogeneity in the application of the new definition among Spanish cardiologists. Those responsible in the medical centers where the diagnosis of an infarct has clinical utility must be informed with regard to the new criteria.

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