ORIGINAL ARTICLE

Effect of Cardiovascular Risk Factors on Long-Term Morbidity and Mortality Following Acute Myocardial Infarction

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Introduction and objectives. Generally, cardiovascular risk factors are poorly controlled after myocardial infarction. The objective of this study was to determine the effect of these risk factors on long-term morbidity and mortality in patients experiencing a myocardial infarction.

Methods. In total, 655 acute myocardial infarction survivors recorded in the IBERICA database for the Spanish province of Albacete were followed up. Provincial healthcare center databases and the regional death registry were consulted, and semistructured interviews were carried out. Bivariate and multivariate descriptive and comparative statistical analyses were performed.

Results. The median follow-up period was 5.5 years. At the end of the study, 74% of patients had hypertension or hypercholesterolemia, 39% had diabetes, 36% were obese, 13% smoked, and 1% were alcoholics. Overall, 48% of patients experienced a cardiovascular event. Uncontrolled hypercholesterolemia was found to be a risk factor for angina (odds ratio [OR], 2.4, 95% confidence interval [CI], 1.1-5.1), and uncontrolled diabetes was a risk factor for reinfarction (OR, 3.5, 95% CI, 1.6-7.6) and stroke (OR, 10.6, 95% CI, 3.6-31.2), both of which occurred earlier in patients with uncontrolled diabetes. In total, 115 (18%) patients died, with more than 50% of deaths being due to cardiovascular causes. Uncontrolled hypertension and diabetes were the most important risk factors for both overall and early mortality, whereas controlled hypercholesterolemia appeared to be a protective factor.

Conclusions. The prevalence of cardiovascular risk factors in patients who have experienced a myocardial infarction is very high. Control of these risk factors influences both cardiovascular events and long-term mortality.

Key words: *Cardiovascular risk factors. Acute myocardial infarction. Follow-up study. Survival.*

Efecto de los factores de riesgo cardiovascular sobre la morbimortalidad a largo plazo después de un infarto agudo de miocardio

Introducción y objetivos. El control de los factores de riesgo cardiovascular después de un infarto de miocardio no es apropiado. El objetivo es estudiar su efecto sobre la morbimortalidad a largo plazo en pacientes con infarto de miocardio.

Métodos. Se realizó el seguimiento a 655 pacientes que sobrevivieron a la fase aguda de un infarto de miocardio (registro IBERICA Albacete) mediante la revisión de los centros sanitarios de la provincia y el boletín regional de defunciones, además de realizar una entrevista semiestructurada. El análisis estadístico fue descriptivo y comparativo, bivariable y multivariable.

Resultados. La mediana de seguimiento fue de 5,5 años. Al finalizar, el 74% presentaba hipertensión arterial o hipercolesterolemia, el 39% diabetes mellitus, el 36% obesidad, el 13% tabaquismo y el 1% alcoholismo. El 48% presentó algún evento cardiovascular. La hipercolesterolemia no controlada fue el factor implicado en la aparición de angina (*odds ratio* [OR] = 2,4; intervalo de confianza [IC] del 95%, 1,1-5,1) y la diabetes no controlada, en la aparición de reinfarto (OR = 3,5; IC del 95%, 1,6-7,6) e ictus (OR = 10,6; IC del 95%, 3,6-31,2). Además, ambos se presentaron de forma más temprana en pacientes diabéticos no controlados.

Fallecieron 115 pacientes (18%) y la etiología fue cardiovascular en más del 50%. La hipertensión arterial y la diabetes no controladas fueron los factores con un mayor riesgo de muerte y de experimentarla más tempranamen-

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te; mientras que la hipercolesterolemia controlada se comportó como un factor protector.

Conclusiones. La prevalencia de los factores de riesgo en pacientes con infarto de miocardio es alta y su control está relacionado tanto con la presencia de eventos cardiovasculares como con la letalidad a largo plazo.

Palabras clave: *Factores de riesgo. Infarto de miocardio. Estudio de seguimiento. Supervivencia.*

ABBREVIATIONS

DM: diabetes mellitus
CVRF: cardiovascular risk factors
HBP: high blood pressure
AMI: acute myocardial infarction

INTRODUCTION

Cardiovascular disease, in particular ischemic heart disease, is now the leading cause of death in industrialized countries.[1] Different factors –cardiovascular risk factors (CVRF)– contribute to its development. In multicenter studies, such as the INTERHEART study, it has been shown that over 90% of the risk of suffering an acute myocardial infarction (AMI) is associated with 9 CVRF, which have a cumulative effect.[2] The survivors of AMI are at high risk of suffering other cardiovascular events,[3] sudden death or recurrent AMI[4] (with a poorer prognosis than that of the first incident).[5] The available scientific evidence shows that the positive modification of CVRF reduces overall cardiovascular risk, the risk of recurrent heart disease, and mortality in these patients[6,7]; this is true even of small improvements in these risk factors.[8] Nonetheless, long term follow-up studies have shown that a high percentage of patients who have suffered an acute cardiac event remain exposed to CVRF.[9-11]

In Spain, the prevalence of CVRF such as smoking, high blood pressure (HBP), hypercholesterolemia, and hyperglycemia is high, and the control of these factors in patients who have experienced an AMI is suboptimal.[12-14] This has led to intervention studies being performed with such patients, both at the moment of hospital release[15] and during the first year of follow-up.[16] The results obtained have been encouraging, but these studies have had several limitations: short follow-up times, the non-randomized nature of the interventions, and the lack of control groups. Moreover, none has assessed the long-term effect of the degree of CVRF control on the appearance of different cardiovascular events (indeed, in Spain there have been no studies in this area with patients who have suffered an AMI).

The aim of the present work was to determine whether any relationship exists between the degree of control of CVRF and the long term appearance of further cardiovascular events or death in patients who have suffered an AMI.

METHODS

The studied patients were those with a clear diagnosis of an AMI recorded in the IBERICA database (a register of AMI among people aged 25-74 covering eight Spanish provinces) for the Province of Albacete, who had been hospitalized between September 1, 1997 and January 1, 2001 and who had survived at least 28 days. This database uses the AMI classification criteria of the MONICA[17] study, which are employed at different centers with a high degree of homology[18]; the concordance between the present researchers in terms of AMI diagnosis was good. The recorded information also included the demographic and clinical characteristics of all patients, the CVRF to which they were exposed, the diagnostic and therapeutic procedures followed, and the appearance of complications over the first 28 days post-AMI.

The follow-up was performed between January 1, 2004 and June 1, 2005. The databases belonging to the province's hospitals and specialist centers, or if necessary the clinical histories of the patients, were examined to record the appearance of further cardiac events, eg, angina that required hospitalization, the need for heart catheterization, AMI, or admission to hospital for heart failure, malignant ventricular arrhythmia (sustained ventricular tachycardia or ventricular fibrillation), supraventricular brady- or tachyarrhythmias (supraventricular tachycardia, atrial fibrillation, or atrioventricular block requiring a pacemaker), as well as vascular events such as stroke (ischemic or hemorrhagic), peripheral artery disease, or disease of the aorta. All events were defined with the appropriate CIE-9 code: 410-414, 427.41, and 427.1, 428, 427.9, 433-438, 441, 442, and 444 respectively. In addition, the patients, or their family members or family doctors, were asked to take part in a semistructured interview in order to confirm where their condition had been monitored and whether (and if so to what extent) their CVRF (HBP, diabetes mellitus [DM], hypercholesterolemia, smoking, obesity, and alcoholism) had been controlled (the last 2 factors were not recorded as part of the IBERICA protocol). Obesity was deemed present when patients autodefined themselves as being overweight or obese and had been advised to lose weight after having suffered an AMI. Alcoholism was defined as the consumption of >80 g of alcohol per day in men, and >40 g per day in women. Follow-up of each CVRF was deemed adequate if the patient attended the appointments set out in the protocols of the primary care centers involved, and their corresponding control considered adequate if, after having been correctly followed-up, the attending physician

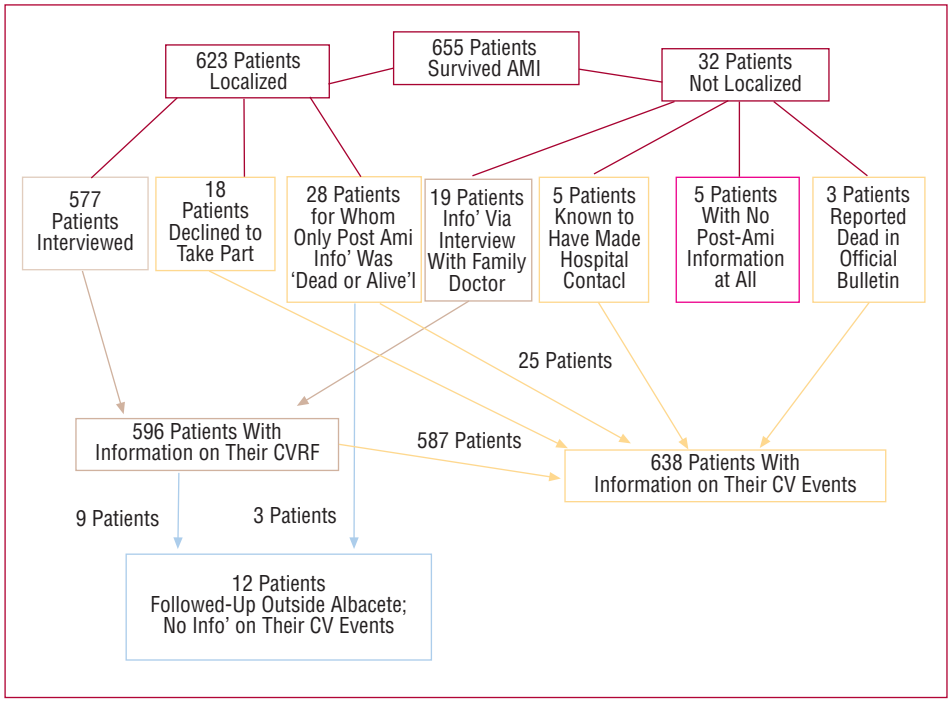

Figure 1. Diagram explaining patient follow-up.
CV indicates cardiovascular; CVRF, cardiovascular risk factors; AMI, acute myocardial infarction.

understood the results to be within acceptable limits. Smokers and drinkers were distinguished as those who had quit or who had maintained their habit during follow-up. A CVRF appearing after the initial AMI was recognized as such when diagnosed by a physician or when patients declared they were being accordingly treated. Among patients who died, follow-up was until the time of death, the cause of which was investigated using the IBERICA methodology (for deaths occurring outside the hospital setting) or by examining hospital records. The regional bulletin of deaths (updated December 2004) was also examined.

The data were examined descriptively and analyzed by bivariate, and multivariate techniques (logistic regression and Cox Proportional Hazard tests [backwards stepwise regression]; significance was set at $P<.10$). The dependent variables used were cardiovascular events (either together or individually) and death; the independent variables used were 3 categories of CVRF –no CVRF, controlled CVRF, and uncontrolled CVRF. Smokers were distinguished as non-smokers at the time of AMI, ex-smokers since the AMI, and active smokers. The confounding variables were understood to be sex, age (≤45, 46-65, and >65 years), others associated with the AMI (dichotomous) –percutaneous transluminal coronary angioplasty, surgery, complication (reinfarction, angina, cardiogenic shock, mechanical complications, malignant ventricular arrhythmias, and stroke)–, and the treatment followed at the time of release from hospital (β-blockers, antiaggregant agents, angiotensin converting enzyme inhibitors [ACE inhibitors], and calcium antagonists). The use of blood lipid reducing agents was not recorded in the IBERICA database. Significance was set at $P<.05$; associations were measured via the odds ratio (OR) or hazard ratio (HR). Population estimates are provided along with their 95% confidence intervals (95% CI).

RESULTS

The number of the potential study population numbered 655 (21% women; 95% CI, 18%-24%). The mean age at the time of AMI was 61 years (95% CI, 60-62 years). The median follow-up time was 5.5 years (percentile $[P]_{25-75}$=5-6 years; range, 1 month-8 years). Of the 623 patients localized, 18 did not wish to take part, and for 28 no data were available except for their being alive or having died. Among the 32 patients not localized, CVRF information was obtained from the family doctor in 19 cases; the death of 3 was learned of via the corresponding regional bulletin. Although 5 patients were seen to have been in contact with the reference hospital, no information on them was available. No information could be found at all on 5 further patients since their episode of AMI. These last 10 patients were considered lost (Figure 1).

Characteristics of Patients With Incomplete Information

Among the lost patients there were more smokers (80% compared to 38% among those with complete information; P=.007). These patients also more commonly had a left

TABLE 1. Prevalence of Cardiovascular Risk Factors At The End of Follow-Up

CVRF	No.	Valid†	Prevalence	95% CI
High blood pressure	452	613	73.7	70.2-77.3
Hypercholesterolemia	418	566	73.8	70.1-77.6
Diabetes mellitus	244	615	39.7	35.7-43.6
Smoking	76	590	12.9	10.3-15.9
Obesity	212	590	35.9	32.1-40.0
Alcoholism	6	588	1.0	0.3-1.6

*CVRF indicates cardiovascular risk factors; CI, confidence interval.
†Valid for analysis.

ventricular ejection fraction of <35% at the time of their AMI (40% compared to 5%; *P*<.0001).

The patients for whom no CVRF data were available during follow-up were older at the time of their AMI (mean age 66 versus to 61 years; *P*=.003), received fewer fibrinolytic agents (23% versus to 41%; *P*=.04), and were more commonly followed up in a provincial hospital or outside Albacete. In addition, they also more commonly suffered heart failure, and more commonly suffered peripheral heart disease and sudden death as a new event (18%, 14%, and 7% versus to 5%, 2%, and 1%; *P*<.0001). Death was also more common among them (68% versus to 15%; *P*<.0001). Among the 18 patients who did not wish to take part, more were diabetic (56% versus to 32%; *P*=.03) and more suffered dyspnea before the original AMI (33% versus to 9%; *P*=.003). In addition, they were less likely to have received β-blockers at release (22% versus to 52%; *P*=.01), and during follow-up were more likely to have experienced reinfarction, malignant arrhythmia, ischemic stroke, or sudden death as a first new event (16.7%, 5.6%, 11.1%, and 5.6% versus to 4%, 0.7%, 2.1%, and 1.4%; *P*=.02), to experience complications (reinfarction – 22% versus to 7%; *P*=.01; malignant arrhythmias – 6% versus to 1%; *P*=.04), or to have died (61% versus to 16%; *P*<.0001).

Descriptive Analysis

Table 1 shows the CVRF to which the patients were exposed at the end of follow-up. High blood pressure and hypercholesterolemia were the most prevalent.

Among the 638 patients for whom cardiovascular event information was available, 309 (48.4%; 95% CI, 44.5%-52.4%) suffered some form of problem: 283 experienced a cardiac event (44%; 95% CI, 40.5%-48.3%) and 54 some form of vascular event (8.5%; 95% CI, 6.5%-11.0%). The most common event was angina, followed by heart failure, and AMI (Figure 2). The time of appearance of the different types of event differed significantly (as determined by the Kruskal-Wallis test; *P*=.03), the earliest being heart failure and malignant ventricular arrhythmias (Figure 3).

A total of 115 patients died (17.6%; 95% CI, 14.6%-20.5%): 11 of unknown causes (1.7%; 95% CI, 0.6%-2.7%), 39 of non-cardiovascular causes (5.9%; 95% CI,

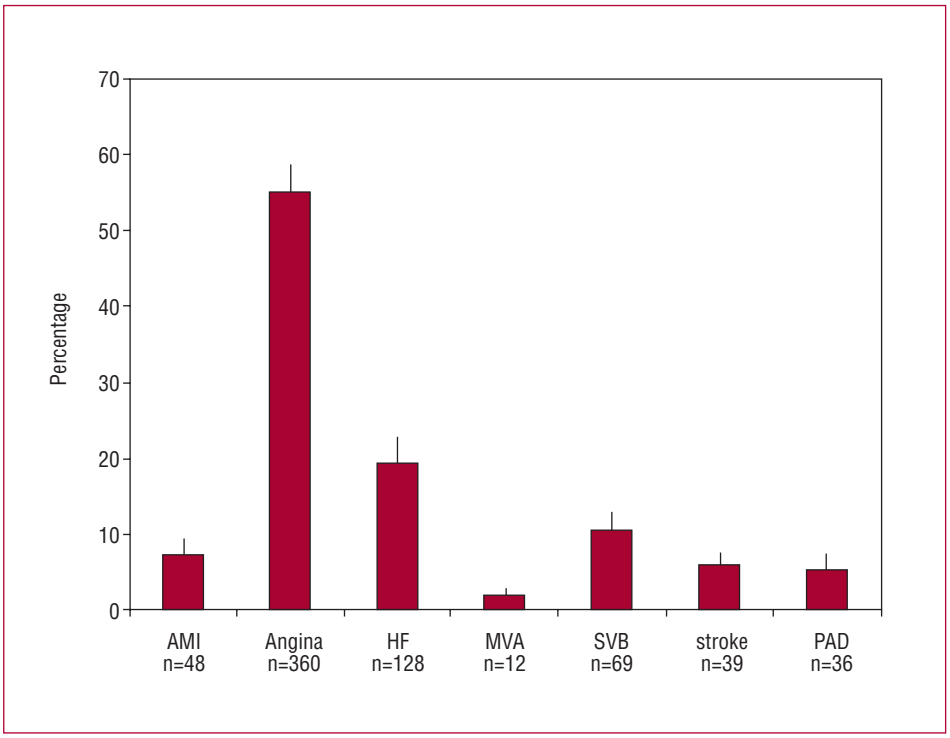

Figure 2. Incidence of cardiovascular events at the end of follow-up. PAD indicates peripheral artery disease or aorta disease; SVB, supraventricular brady- or tachyarrhythmia; MVA, malignant ventricular arrhythmia; HF, heart failure.

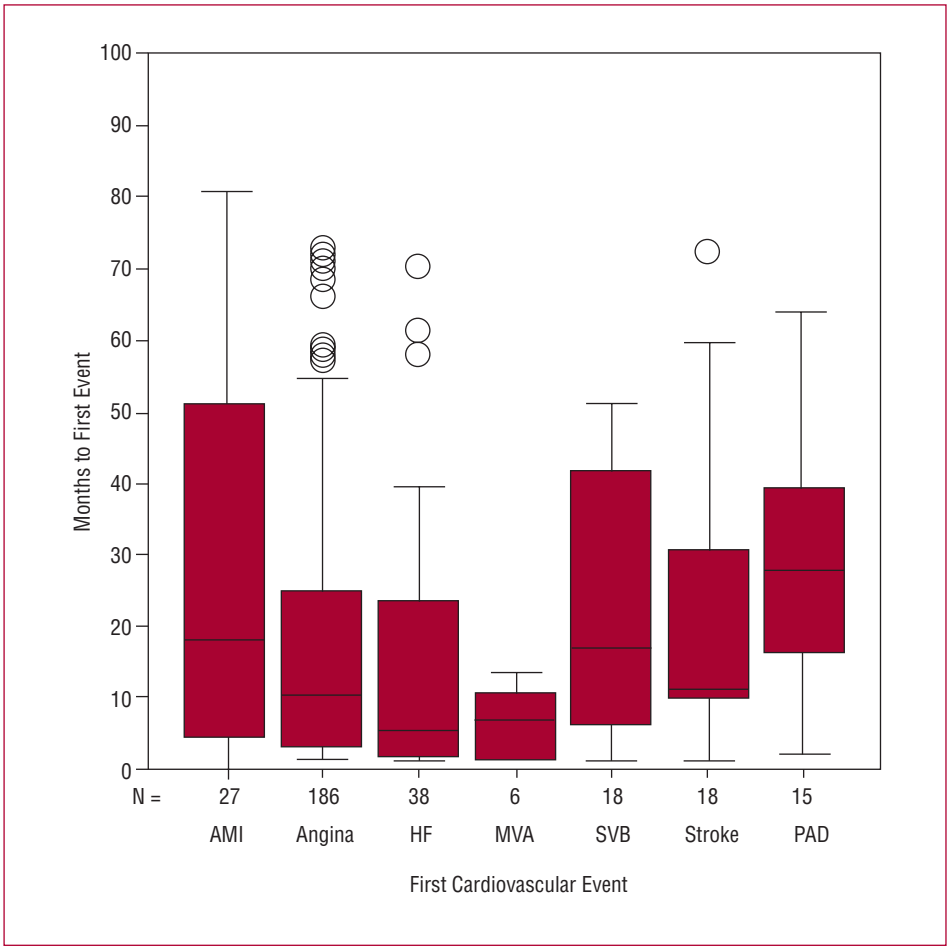

Figure 3. Box diagram showing months until the appearance of the first post-infarction cardiovascular event.
PAD indicates peripheral artery disease or aorta disease; SVB, supraventricular brady- or tachyarrhythmia; MVA, malignant ventricular arrhythmia; HF, heart failure.
*In 9 patients SVB coincided with some other event.

4.1%-7.8%), 17 of vascular causes (2.6%; 95% CI, 1.6%-3.9%), and 48 of cardiac causes (7.3%; 95% CI, 5.2%-9.4%). In this last group, 16 patients died suddenly (2.4%; 95% CI, 1.5%-3.9%). Some 62.5% of deaths of known etiology were cardiovascular in nature (95% CI, 52.7%-72.3%); this would have ranged from 56%-66% if the etiology of all the deaths had been known. The median time to death was 32.6 months (P_{25-75}: 13.2-32.6 months; range, 1-91 months). No significant difference was seen between the moment of deaths due to different etiology (Figure 4).

Relationship Between Cardiovascular Risk Factors and Cardiovascular Events

The patients with DM suffered more vascular events than those who did not have DM (10.3% compared to 4.0%; *P*=.0001); the same was true for those with HBP compared to normotensive subjects (15.1% compared to 5.5%; *P*=.01), and of those who had a background of HBP before their AMI compared to those diagnosed with this problem during follow-up (12.9% compared to 5.0%; *P*=.01). For HBP this was maintained with respect to all cardiovascular events. Among patients with some CVRF, no significant relationship was found between the degree of follow-up and control of these problems and the appearance of cardiovascular events as a whole. A significant relationship was seen, however, between those in whom CVRF were controlled (ie, in whom results within the normal range were not achieved), those in whom CVRF control was achieved, and those who did not have CVRF (Tables 2 and 3). Hypercholesterolemia was the CVRF most independently associated with angina and peripheral artery disease, and DM that most independently associated with AMI and stroke. No significant, independent relationship was seen between any event and the degree of control of HBP, obesity, smoking, or alcoholism, even when the dichotomous variable of with/without CVRF was included in analyses (results not shown).

Patients with uncontrolled DM were more likely to suffer any form of event before patients without DM (HR 1.8; 95% CI, 1.3-2.5). When the different events were considered individually, uncontrolled hypercholesterolemia was associated with an earlier appearance of angina (HR, 1.8; 95% CI, 1.1-3.1), uncontrolled DM with an earlier

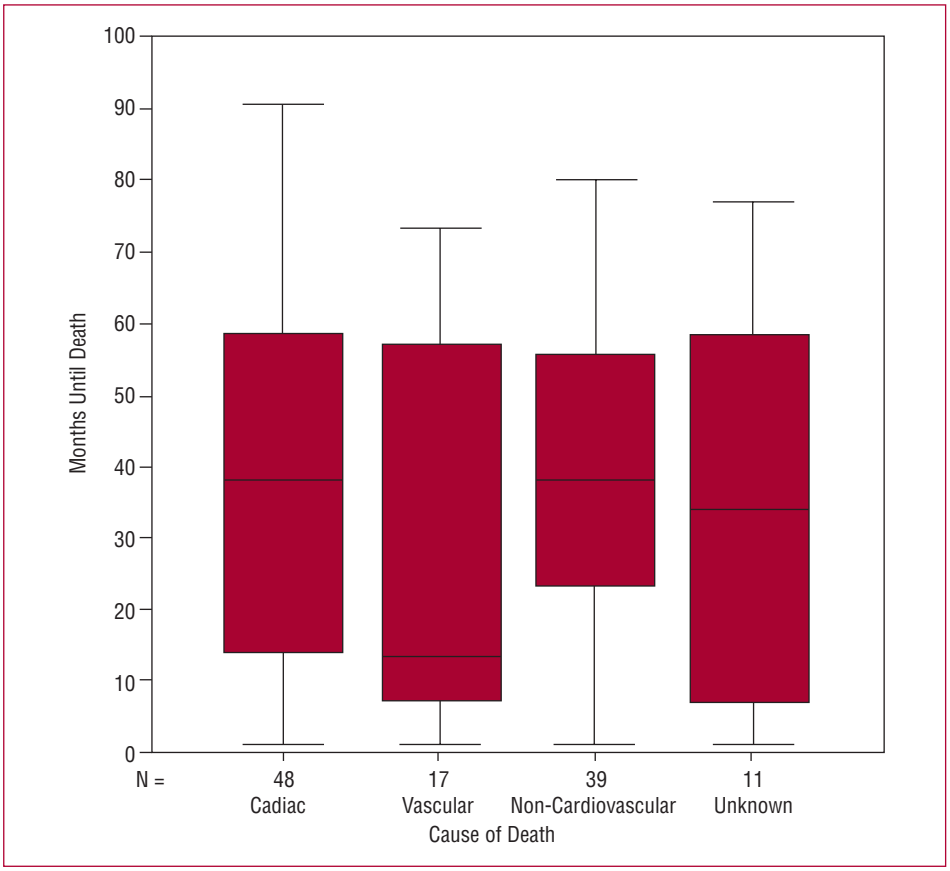

Figure 4. Box diagram showing months until death of different etiology.
CV indicates cardiovascular.

TABLE 2. **Relationship Between Degree of Control of Cardiovascular Risk Factors and the Appearance of Cardiovascular Events. Bivariate Analysis***

	Angina		AMI		HF		SVB		Stroke		PAD	
CVRF	**%**	***P* Pearson χ^2 χ^2 Trend**	**%**	***P* Pearson χ^2 χ^2 Trend**	**%**	***P* Pearson χ^2 χ^2 Trend**	**%**	***P* Pearson χ^2 χ^2 Trend**	**%**	***P* Pearson χ^2 χ^2 Trend**	**%**	***P* Pearson χ^2 χ^2 Trend**
High blood pressure		NS		NS		NS		NS		.1		NS
No									1.9	.04		
Controlled									5.8			
Uncontrolled									7.3			
Hypercholesterolemia		.03		NS		NS		NS		NS		.03
No	26.1	.007			13.7	.05					5.9	NS
Controlled	35.6				8.1						1.9	
Uncontrolled	45.5				6.8						6.8	
Diabetes		NS		.003		.01		NS		<.0001		NS
No			5.5	.01	7.3	.004			1.6	<.0001	2.4	.09
Controlled			4.2		11.3				7.7		4.2	
Uncontrolled			14.6		18.1				15.3		6.9	
Obesity		NS		NS		NS		NS		NS		NS
No	31.3	.04										
Controlled	38.5											
Uncontrolled	40											
Smoking		.04		NS		.1		.001		NS		NS
No	33.5	NS			12	.08	8.7	.002			2.6	.09
Ex-smoker since AMI	39.8				6.2		1.2				3.7	
Active smoker	23.4				7.8		2.6				6.5	

*PAD indicates peripheral artery disease or aorta disease; SVB, supraventricular brady- or tachyarrhythmia; CVRF, cardiovascular risk factors AMI, acute myocardial infarction; HF, heart failure; NS, not significant. The results are shown for values of *P*<.10.

TABLE 3. **Relationship Between Degree of Control of Cardiovascular Risk Factors and the Appearance of Cardiovascular Events***

CVRF	AMI			Angina			Stroke			PAD		
	OR Raw (95% CI)	OR Adjusted (95% CI)	*P*	OR Raw (95% CI)	OR Adjusted (95% CI)	*P*	OR Raw (95% CI)	OR Adjusted (95% CI)	*P*	OR Raw (95% CI)	OR Adjusted (95% CI)	*P*
HCHO			NS			.04			NS			.04
No				1	1					1	1	
Controlled				1.6 (1.1-2.3)	1.6 (1.0-2.4)	.05				0.4 (0.1-1.0)	0.4 (0.1-1.0)	.04
Uncontrolled				2.1 (1.1-4.0)	2.4 (1.1-5.1)	.02				1.4 (0.4-4.7)	1.5 (0.4-5.1)	.5
Diabetes			.002			NS			<.0001			NS
No	1	1					1	1				
Controlled	0.8 (0.3-1.9)	0.7 (0.3-1.9)	.5				5.3 (1.9-14.5)	4.9 (1.7-13.8)	.003			
Uncontrolled	2.9 (1.4-6.1)	3.5 (1.6-7.6)	.002				10.7 (3.9-29.0)	10.6 (3.6-31.2)	<.0001			

*PAD indicates peripheral artery disease or aorta disease; CVRF, cardiovascular risk factors; AMI, acute myocardial infarction; HCHO, hypercholesterolemia; CI, confidence interval; NS, not significant; OR, odds ratio. Multivariate analysis (logistic regression). Model adjusted for the number of CVRF, sex, stratified age, serious complications of AMI, treatment of AMI by surgery or coronary angioplasty, and hospital release with β-blockers, antiaggregants, angiotensin converting enzyme inhibitors, or calcium antagonists prescribed.

appearance of AMI (HR, 3.1; 95% CI, 1.5-6.4), controlled DM with stroke (HR, 4.5; 95% CI, 1.6-12.6), and uncontrolled DM with stroke (HR, 8; 95% CI, 2.9-22).

Relationship Between Cardiovascular Risk Factors and Mortality

In the bivariate analysis, the presence and degree of follow-up and control of CVRF was seen to affect cardiovascular mortality and all-cause mortality (Table 4), but not sudden death. In the multivariate analysis, uncontrolled HBP appeared as a risk factor for both sudden death and cardiovascular death. Uncontrolled DM was a risk factor for overall and cardiovascular mortality. Controlled hypercholesterolemia had a protective effect with respect to both cardiovascular and overall mortality (Table 5). Similar results were obtained when the moment of death was taken into account (Table 6). No convergence was seen for sudden or non-cardiovascular death in Cox regression analysis.

DISCUSSION

Patients With Incomplete Information

For the patients as a whole, the median follow-up time was 6 years. Information was incomplete for only 59 patients (9%); all post-AMI information was lacking in only 5 patients (<1%). These percentages are lower than those reported by the authors of similar studies, such as de Velasco et al[13] who reported 7% of missing at 6 months, or Serrano et al[19] who reported a 2% of missing (over an unstated length of time and with unstated follow-up criteria) in a sample smaller than that of the present study.

Those patients who did not wish to take part were more likely to be diabetic and showed more complications during their recorded follow-up. Although they were less likely to receive β-blockers, not including these patients in the analysis may have led to an underestimation of the risk associated with DM (which even so was recorded as serious).

The missing patients were more likely to be smokers and to have a poorer left ventricular ejection fraction. Theoretically this must have worsened their prognoses, although none of these patients appeared in the regional bulletin of deaths. The loss of these patients from the study may have had an influence on the effect of smoking.

For the patients for whom no CVRF data were available during follow-up, no differences were seen in terms of the prevalence of CVRF at the time of their AMI (compared to those who were adequately followed up). They were more likely to reside outside the city of Albacete, which probably hindered the obtention of information. Although it cannot be ruled out that there were differences in the control of these patients' CVRF,

TABLE 4. **Relationship Between the Presence and the Degree of Follow-Up and Control of Cardiovascular Risk Factors and Cardiovascular, and All-Cause Mortality***

CVRF	N	Cardiovascular Death	*P*†	Death by Any Cause	*P*†
High blood pressure					
High blood pressure: yes/no	452/161	11.8/5.4	.03	17.9/13.7	–
Follow-up: yes/no	375/36	9.5/2.9	–	13.3/8.3	–
Controlled: yes/no	330/42	7.0/23.8	<.0001	11.2/25.6	.008
Hypercholesterolemia					
Hypercholesterolemia: yes/no	418/149	7.7/10.5	–	11.8/20.1	.01
Follow-up: yes/no	381/21	6.0/15.0	–	8.9/19.0	–
Controlled: yes/no	344/30	6.0/6.7	–	8.9/16.7	–
Diabetes					
Diabetes: yes/no	224/348	16.1/5.5	<.0001	23.0/11.3	<.0001
Follow-up: yes/no	194/17	12.1/0	–	17.1/0	.08
Controlled: yes/no	129/64	7.4/21.7	.005	12.4/26.6	.01
Smoking					
Smoker at time of AMI: yes/no	253/401	5.5/14.1	.001	11.9/21.2	.002
Smoker during follow-up: yes/no	77/543	12.7/9.5	–	19.5/15.8	–

*CVRF indicates cardiovascular risk factors; AMI, acute myocardial infarction.
†χ^2 Pearson.

the fact that they received significantly less thrombolytic treatment, and that they were older, may explain the differences seen with those who were followed-up.

Cardiovascular Events and Their Relationship With Cardiovascular Risk Factors

Almost 50% of patients for whom the incidence of cardiovascular events was known had at least one CVRF. The number of events recorded is higher than that reported by Zaliunas et al[20] (29%). This might be due to the fact that in the latter study the follow-up time was shorter and fewer events were recorded (reinfarction, cardiac revascularization, and cardiovascular death). The most common cardiac event was angina, and the most common vascular event ischemic stroke. The same findings were also reported by de Velasco et al[12] and Rothwell et al[21], respectively.

One of the most important results of the present work was that cardiovascular events were associated with different CVRF. For example, DM was a strong risk factor for ischemic a stroke or reinfarction; patients with uncontrolled DM were 10 times more likely to suffer this, and 3.5 times more likely to suffer another AMI than non-diabetics. Patients with uncontrolled DM were also more likely to suffer these problems and to suffer a first event earlier. Even the patients with controlled DM were 5 times more likely to suffer. These results agree with those of Casella et al[22] and Levantesi et al,[23] who report DM to be one of the most important risk factors for new cardiovascular events following an AMI. Kamper et al[24] observed an incidence of stroke among patients with DM who had suffered an AMI to be even higher than that reported in the present study (31% compared to 10.5%; 95% CI, 6.4%-14.5%); this may be partly explained in that the present study did not take into account the acute phase following AMI.

Hypercholesterolemia was associated with the appearance of angina (patients in whom this was not controlled were at twice the risk compared to those who did not have hypercholesterolemia); it also appeared earlier in patients with this problem. These results are in agreement with that indicated by Ong,[25] who found that statins were as beneficial as angioplasty for reducing ischemic events in patients with stable angina. However, the patients with controlled hypercholesterolemia appeared less likely to suffer peripheral artery disease than those who do not have this CVRF –probably a result of treatment; oddly, those in whom this problem was not controlled appeared to be at no greater risk. This might be explained by the sample size.

Smoking does not seem to be a risk factor for cardiovascular events, nor does quitting smoking appear to have a protective effect. This result may be explained by the small number of smokers in the sample, and a need for longer follow-up times. In addition, the comparisons were made between patients who had suffered an AMI, not between these and healthy persons. It should also be remembered that the lost patients smoked significantly more.

Relationship of Risk Factors With Mortality

The degree of follow-up and control of CVRF was significantly associated with both cardiovascular and all-cause mortality. Survival among patients with

TABLE 5. **Relationship Between the Control of Cardiovascular Risk Factors and Mortality***

CVRF	Overall Mortality			Sudden Death			CV-Death			Non CV-Death		
	OR Raw (95% CI)	OR Adjusted† (95% CI)	*P*	OR Raw (95% CI)	OR Adjusted‡ (95% CI)	*P*	OR Raw (95% CI)	OR Adjusted§ (95% CI)	*P*	OR Raw (95% CI)	OR adjusted‖ (95% CI)	*P*
HBP			NS			.05			.02			NS
No				1	1		1	1				
Controlled				1.3 (0.3-6.6)	0.9 (0.2-3.4)	NS	1.7 (0.8-3.8)	0.9 (0.4-2.3)	NS			
Uncontrolled				12.8 (2.9-57)	4.1 (0.95-19.2)	.03	4.0 (1.6-10.1)	3.4 (1.1-10.7)	.04			
HCHO			.03			NS			NS			.02
No.	1	1								1	1	
Controlled	0.5 (0.3-0.8)	0.4 (0.3-0.8)	.0008							0.3 (0.2-0.7)	0.3 (0.1-0.7)	.005
Uncontrolled	0.6 (0.2-1.4)	0.6 (0.2-1.9)	NS							0.2 (0.03-1.7)	0.3 (0.04-2.3)	NS
DM			.05			NS			.02			NS
No	1	1					1	1				
Controlled	1.3 (0.8-2.1)	1.3 (0.6-2.4)	NS				1.6 (0.8-3.3)	1.7 (0.7-3.9)	NS			
Uncontrolled	2.0 (1.2-3.3)	2.6 (1.2-5.4)	.01				3.2 (1.6-6.3)	3.6 (1.4-8.9)	.006			

*CV indicates cardiovascular; CVRF, cardiovascular risk factors; AMI, acute myocardial infarction; CI, confidence interval; ACEi, angiotensin converting enzyme inhibitors; HBP, high blood pressure; NS, not significant; OR, odds ratio.
Multivariate analysis (logistic regression). Model adjusted for the number of CVRF, sex, stratified age, serious complications of AMI, treatment of AMI by surgery or coronary angioplasty, and hospital release with β-blockers, antiaggregants, angiotensin converting enzyme inhibitors, or calcium antagonists prescribed.
†Variables in the model: age, complications of AMI, surgery, and β-blockers.
‡Variables in the model: coronary angioplasty.
§Variables in the model: age, β-blockers, ACEi, coronary angioplasty, and surgery.
‖Variables in the model: age and complications at AMI.

hypercholesterolemia or DM was poorer than among those without these risk factors. However, no significant difference in mortality was seen between hypertensive and normotensive patients. This might be explained by the fact that one third of the hypertensive patients were diagnosed as such during follow-up, and a longer period might be needed for any effect of HBP on survival to be noticed. Nonetheless, uncontrolled HBP does appear to be a risk factor for sudden death and cardiovascular death in general. Patients with uncontrolled HBP survived for less time.

Patients with DM showed poorer survival rates. Inadequate control of this risk factor was associated with a greater risk of death (particularly cardiovascular death) and at an earlier time.

Patients with hypercholesterolemia showed better survival rates than those without risk factor; those who were controlled for this also had better survival rates than those free of this problem. The controlled patients had a lower risk of cardiac and all-cause death, which, if did occur, was likely to be later. This effect was maintained in patients receiving pharmacological treatment whether or not their cholesterol levels were brought to normal (results not shown). This might be explained by a beneficial effect of treatment (probably statins), although no information was collected in this area. The beneficial effect of these agents on the appearance of cardiovascular events and death has been reported,[26-29] although in the present study treatment seemed to be related to reduced overall mortality rather than cardiovascular mortality, and without this benefit being attributable to a smaller incidence of cardiovascular events.

In bivariate analysis the patients who were smokers at the time of their AMI had better long-term survival, although this relationship disappeared in the multivariate analysis. No significant relationships were found between death and obesity or alcoholism.

Limitations

The characteristics of the patients were similar to those described in other papers[30-33] despite the fact that the age criterion of the MONICA[17,18] study (<75 years) reduces the representation of women. The incidence of AMI and angina could have been under- and overestimated respectively since the diagnosis of AMI was changed during the follow-up period.[34] The assessment of the diagnosis and of the control of CVRF during follow-up was conditioned by the design of the work (interview at the end of follow-up), and depended on the honesty of the patients. It cannot

TABLE 6. **Relationship Between the Control of Cardiovascular Risk Factors and the Moment of Death***

CVRF	CV Mortality			Overall Mortality		
	HR Raw (95% CI)	HR Adjusted† (95% CI)	*P*	HR Raw (95% CI)	HR Adjusted† (95% CI)	*P*
High blood pressure			.006			.005
No	1	1		1	1	
Controlled	1.2 (0.6-2.4)	0.8 (0.4-1.7)	NS	0.7 (0.5-1.2)	0.8 (0.4-1.3)	NS
Uncontrolled	4.5 (2.1-9.5)	2.4(1.1-5.4)	.003	2.8 (1.7-4.8)	2.0 (1.1-3.7)	.03
Hypercholesterolemia		-	NS			.001
No				1	1	
Controlled				0.3 (0.2-0.5)	0.4 (0.2-0.6)	<.0001
Uncontrolled				0.8 (0.4-1.5)	0.6 (0.3-1.3)	NS
Diabetes			<.0001			.001
No	1	1		1	1	
Controlled	1.4 (0.7-2.9)	1.1 (0.4-2.6)	NS	1.0 (0.6-1.7)	0.9 (0.5-1.8)	NS
Uncontrolled	4.5 (2.4-8.2)	4.0 (2.0-7.7)	.01	2.8 (1.8-4.5)	2.6 (1.5-4.4)	<.0001

*CV indicates cardiovascular; CVRF, cardiovascular risk factors; AMI, acute myocardial infarction CI, confidence interval; HR, hazard ratio; NS, not significant; OR, odds ratio.
Multivariate analysis (Cox regression). Model adjusted for the number of CVRF, sex, stratified age, serious complications of AMI, treatment of AMI by surgery or coronary angioplasty, and hospital release with b-blockers, antiagregants, angiotensin converting enzyme inhibitors, or calcium antagonists prescribed.
†Variables in the model: age, surgery, and β-blockers.

be ruled out that the patients' prognoses did not influence their estimates regarding follow-up and control. However, the results recorded appear to be reliable since the percentage of patients that continued to smoke after their AMI was similar to that reported by other authors,[2,3,9,14] the reported degree of control of the other risk factors is therefore probably reliable. Although the assessment of exposure to CVRF via an interview may seem an inexact method, anamnesis is the usual approach of the clinician, and, in our opinion, provides a better picture of secondary prevention than that achieved by the information gathered in programmed appointments.

Application

This work provides valuable information with regard to the long-term treatment of patients with AMI (information that is of use in the clinician and to health institutions) and could help to reduce its associated morbidity and mortality.

CONCLUSIONS

The prevalence of CVRF among the present patients, all of whom had suffered an AMI, was high; almost 50% of patients with a CVRF suffered a further cardiovascular event. The occurrence of these events in the long term is associated with the inadequate control of CVRF. Long-term mortality was also high and related significantly to an inadequate control of DM and HBP. Patients with hypercholesterolemia who received pharmacological treatment for this problem showed better survival rates than those who did not have this problem, irrespective of whether their cholesterol levels were maintained within the normal range.

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