

Original article

Prior adherence to recommended lipid control targets in patients admitted for acute coronary syndrome



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ABSTRACT

Introduction and objectives: Optimal lipid control is difficult to attain. We assessed preadmission achievement of the European Society of Cardiology targets for low-density lipoprotein-cholesterol (LDL-C) control in patients admitted for acute coronary syndrome.

Methods: Fasting LDL-C levels were measured in 3164 patients admitted between 2010 and 2017. We assessed the frequency of adequate LDL-C control, with targets defined according to individual cardiovascular risk, and the predictors of inadequate control.

Results: The median LDL-C value was 104 (80–130) mg/dL. Most patients had high or very high cardiovascular risk and only 34.2% had LDL-C levels below the recommended target for their estimated risk. Achievement of LDL-C goals increased moderately throughout the study period. Adequate LDL-C control was inversely associated with patient risk. Dyslipidemia, active smoking, diabetes mellitus, and body mass index ≥ 25 were independent predictors of inadequate lipid control, while ongoing statin therapy was associated with adequate control.

Conclusions: Only slightly more than one third of patients admitted for acute coronary syndrome meet recommended LDL-C targets on admission. There is broad scope for improvement in primary and secondary prevention, especially among patients who are overweight or have other cardiovascular risk factors.

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Cumplimiento previo de los objetivos recomendados de control lipídico para pacientes que ingresan por síndrome coronario agudo

RESUMEN

Introducción y objetivos: El control lipídico óptimo es difícil de conseguir. Se evalúa el cumplimiento previo de los objetivos de la Sociedad Europea de Cardiología para el control del colesterol unido a lipoproteínas de baja densidad (cLDL) de los pacientes que ingresaron por síndrome coronario agudo.

Métodos: Se midió el cLDL en ayunas de 3.164 pacientes ingresados entre 2010 y 2017 y se analizó la frecuencia de un control adecuado, con objetivos según el riesgo cardiovascular individual, y los predictores de control inadecuado.

Resultados: La mediana de cLDL fue 104 (80–130) mg/dl. La mayoría de los pacientes tenían un riesgo cardiovascular alto o muy alto y solo el 34,2% tenía un cLDL dentro del objetivo recomendado para su nivel de riesgo. Se apreció un pequeño aumento en la consecución de los objetivos de cLDL a lo largo del periodo estudiado. El control adecuado de cLDL se relacionó inversamente con el riesgo de los pacientes. La dislipemia, el tabaquismo, la diabetes mellitus o un índice de masa corporal ≥ 25 fueron predictores independientes de un control lipídico inadecuado, mientras que el tratamiento previo con estatinas se asoció con un control apropiado.

Conclusiones: Poco más de un tercio de los pacientes ingresados por síndrome coronario agudo tiene valores de cLDL al ingreso acordes con los objetivos recomendados. Hay un amplio campo de mejora en prevención primaria y secundaria, especialmente para los pacientes con exceso de peso u otros factores de riesgo cardiovascular.

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Palabras clave:

Colesterol

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Abbreviations

HDL-C: high-density lipoprotein-cholesterol
LDL-C: low-density lipoprotein-cholesterol
ESC: European Society of Cardiology
ACS: acute coronary syndrome

INTRODUCTION

Dyslipidemia is common in patients with acute coronary syndrome (ACS).^{1–4} One of the cornerstones of cardiovascular disease prevention is a low-density lipoprotein-cholesterol (LDL-C) reduction due to its association with lower rates of cardiovascular events in both apparently healthy individuals and patients with other risk factors or those who have experienced an acute event.^{5–8} A meta-analysis of 26 clinical trials that evaluated the effect of statins on almost 170 000 patients concluded that each 1 mmol/L (38.67 mg/dL) reduction in LDL-C is linked to a 22% lower 5-year incidence of major cardiovascular events,⁵ with a greater absolute benefit for patients with previous events. For this reason, the guidelines of the European Society of Cardiology (ESC), in agreement with the European Atherosclerosis Society and other scientific societies, recommend an LDL-C reduction in the population at risk, with more or less strict targets according to individual cardiovascular risk.^{9–11} However, despite the strength of the available evidence, in practice, the lipid control of patients is difficult and often inadequate.^{12–20}

Little is known about the prior LDL-C control of patients admitted for ACS or about the factors associated with inadequate lipid control in this population. This information could help to identify the people most likely to benefit from interventions. Accordingly, we decided to analyze, in patients admitted for ACS to a tertiary hospital with a large referral population, the degree of prior adherence to the recommended LDL-C targets and the changes in adherence in recent years and to identify the variables associated with inadequate lipid control.

METHODS

Patients

The registry of patients admitted for suspected ACS to the coronary care unit of our center (a tertiary hospital with a referral population of more than 400 000 people) was reviewed between January 1st, 2010, and April 30st, 2017. This systematically and prospectively compiled registry collected their main demographic data, risk factors, comorbidities, previous treatments, clinical presentation, clinical course during admission, results of complementary examinations, including the fasting lipid profile obtained on the morning of the first working day after admission, and treatments during admission and at discharge, according to established recommendations.²¹ The exclusion criteria were patients transferred from another center, those who had ACS while they were hospitalized for another reason, those whose early lipid profile was unavailable because they were quickly transferred to another hospital or for any other cause, and those whose final diagnosis was not ACS. The study was approved by the clinical research ethics committee of our hospital.

Definition of preadmission lipid control targets

LDL-C concentrations were calculated using the Friedewald formula²² or were directly measured after ultracentrifugation in individuals with significant hypertriglyceridemia. Patients were deemed to have adequate lipid control at admission if their LDL-C concentrations were within the limits established by the applicable European guidelines on cardiovascular prevention¹⁰ or dyslipidemia management.¹¹ According to these recommendations, the LDL-C target is < 70 mg/dL (or a \geq 50% reduction if the baseline level is 70–135 mg/dL) in patients with documented cardiovascular disease and in those in primary prevention considered at very high risk due to the presence of diabetes with target organ damage or of an associated major cardiovascular risk factor, severe chronic kidney disease (estimated glomerular filtration rate < 30 mL/min/1.73 m²), or an estimated 10-year risk of cardiovascular mortality \geq 10%; the LDL-C target is < 100 mg/dL (or a \geq 50% reduction if the baseline level is 100–200 mg/dL) in patients considered at high risk due to the presence of a poorly controlled risk factor, diabetes mellitus without the above criteria, moderate chronic kidney disease (estimated glomerular filtration rate 30–59 mL/min/1.73 m²), or an estimated 10-year risk of cardiovascular mortality of 5% to 10%. The target is < 115 mg/dL in the other patients with an indication for lipid-lowering therapy due to a moderate estimated risk. Finally, there is no defined target in the rest of the population, although an LDL-C \geq 155 mg/dL is considered inappropriate, unless the estimated risk is extremely low. Due to the limitations in the available information, only the absolute LDL-C targets were considered in the present study because the values prior to therapy initiation were not available for most patients undergoing lipid-lowering therapy and no attempt was made to retrospectively estimate the 10-year risk of cardiovascular mortality.

Statistical analysis

Categorical variables are expressed as numbers and percentages and continuous variables as median [interquartile range]. Two categorical variables were compared using the chi-square test, whereas 2 continuous variables were compared using the Mann-Whitney *U* test. The presence of temporal trends in lipid target adherence was evaluated by comparing 4 consecutive time periods. Comparisons among these periods and among other ordinal variables, such as cardiovascular risk categories, were made using the chi-square test for linear trend for categorical variables and by the Jonckheere-Terpstra test for continuous variables. Variables independently associated with inadequate lipid control at admission were identified through multivariable logistic regression analysis with step-by-step elimination that included demographic variables, other cardiovascular risk factors, and the main comorbidities. Model calibration was assessed using the Hosmer-Lemeshow test and its discriminative capacity using the C statistic. A sensitivity analysis was performed by excluding patients who were admitted on Friday or Saturday and therefore lacked a lipid profile in the first 24 hours of admission. However, these patients were kept in the study after verification that the results were practically unchanged. Through multivariable logistic regression analysis, the association between lipid control and hospital mortality was analyzed and the population attributable risk was calculated according to the methodology described.²³ All analyses were performed with SPSS statistical software. *P* values < .05 were considered significant.

RESULTS

During the study period, 4218 patients were admitted to our unit with suspected ACS; because 1054 patients were excluded for the reasons detailed in [figure 1](#), the study population comprised 3164 patients.

The median age of the patients was 65 [54–76] years, 76.1% were male, and 56.1% had persistent ST-segment elevation. The baseline cardiovascular risk, calculated as described above, was very high in 1393 patients (44.0%; in 901 [28.5%] due to known cardiovascular disease and in 492 [15.5%] due to other characteristics); in addition, 1443 (45.6%) had high risk, 144 (4.6%) had intermediate risk and an indication for lipid-lowering therapy, and 184 (5.8%) had none of these characteristics. The main characteristics of these 4 groups are summarized in [table 1](#). Patients with higher risk were older than the others and, as expected, had a higher prevalence of cardiovascular risk factors and more frequently received drugs for cardiovascular prevention. Patients with higher baseline cardiovascular risk had a worse clinical presentation and less frequent persistent ST-segment elevation than the others.

The median total cholesterol concentration was 174 [147–205] mg/dL; 104 [80–130] mg/dL for LDL-C and 39 [33–46] mg/dL for high-density lipoprotein-cholesterol (HDL-C). In total, 1083 patients (34.2%) had LDL-C values at admission within the guideline-recommended target range for their previous level of risk. In addition, 59.1% of patients did not exceed the recommended LDL-C target by more than 25% and 78.0% did not exceed it by more than 50%.

[table 2](#) shows the cholesterol concentrations and those of their main fractions, the percentages of patients with ongoing lipid-lowering therapy, and the percentages of patients with adequate lipid control at the time of admission in the 4 risk groups. Almost a third of patients at very high risk and approximately 80% of those at high risk were not taking statins at the time of admission. In addition, although the LDL-C concentrations at admission were lower in patients with higher cardiovascular risk, the proportion of patients with optimal LDL-C levels also decreased as the cardiovascular risk increased. About 30% of the patients at very high risk and 20% of those at high risk had LDL-C values at admission that exceeded the recommended limits by more than 50%.

During hospitalization, 3097 patients (98.0%) received statins. Of the 3027 patients discharged alive, 96.0% were prescribed a lipid-lowering therapy, such as statins in 95.6% and combination therapy in 2.6%.

A significant, although small, tendency for better LDL-C control at the time of admission was observed over the study period. The percentage of patients with optimal control increased by about 4% between the beginning and end of this period ([figure 2](#)).

The baseline characteristics of the patients with adequate or inadequate LDL-C control according to guideline recommendations are shown in [table 3](#). Patients with worse lipid control were younger and had a higher prevalence of overweight or obesity, active smoking, diabetes mellitus, and dyslipidemia and higher estimated cardiovascular risk, whereas renal failure and ongoing lipid-lowering therapy were associated with better LDL-C control. Of the patients taking statins, 37.5% had LDL-C levels within the target range.

The results of the logistic regression analysis are shown in [table 4](#). Dyslipidemia, active smoking, diabetes mellitus, and body mass index ≥ 25 were independent predictors of inadequate LDL-C control, whereas ongoing statin therapy was associated with adequate control. Model calibration was adequate ($P = .303$) and its discriminative capacity low ($C = 0.67$). Independent predictors of very poor LDL-C control ($> 50\%$ above the target) were dyslipidemia, diabetes, smoking, lack of statin therapy, and younger age.

Patients with LDL-C concentrations at admission within the target range had a worse presentation than the other patients (Killip class > 2 , 15.6% vs 9.9%; $P < .001$; GRACE score, 139 [114–169] vs 126 [102–155]; $P < .001$) and higher hospital mortality (7.3% vs 2.8%; $P < .001$). After adjustment for other baseline predictors, adequate lipid control was not associated with mortality (odds ratio = 1.41; 95% confidence interval [95%CI], 0.89–2.23; $P = .139$; population attributable risk, 16.8%; 95%CI, –7.1% to 31.8%).

DISCUSSION

In the present study, 34.2% of patients admitted for ACS to the coronary care unit of a tertiary hospital between 2010 and 2017 had LDL-C values at admission within the target range for their level of risk. There was a slight increase in the percentage of patients with good lipid control during the study period. Patients' LDL-C control was inversely associated with their cardiovascular risk. Dyslipidemia, smoking, diabetes mellitus, and body mass index ≥ 25 were all independent predictors of inadequate control, whereas ongoing statin therapy was associated with adequate control.

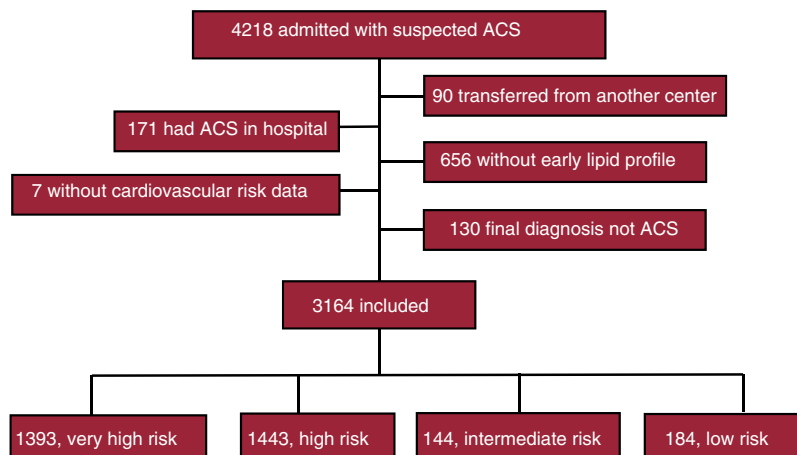


Figure 1. Patient flow diagram. ACS, acute coronary syndrome.

Table 1
Characteristics of the 4 groups of patients according to their baseline cardiovascular risk

	Very high risk (n = 1393)	High risk (n = 1443)	Isolated dyslipidemia (n = 144)	Low risk (n = 184)	P
Age, y	70 [60-79]	59 [50-71]	64 [55-72]	66 [54-72]	< .001
Women	346 (24.8)	334 (23.1)	32 (22.2)	45 (24.5)	.492
Body mass index	27.3 [24.9-30.8]	27.0 [24.5-29.8]	27.1 [24.3-29.4]	26.3 [23.8-29.0]	< .001
<i>Known cardiovascular risk factors</i>					
Active smoking	363 (26.2)	829 (57.6)	0	0	.142
Hypertension	1111 (79.8)	853 (59.2)	0	0	< .001
Diabetes mellitus	920 (66.1)	19 (1.3)	0	0	< .001
Dyslipidemia	1048 (75.3)	705 (48.9)	144 (100)	0	< .001
<i>History and comorbidities</i>					
Ischemic heart disease	681 (48.9)	0	0	0	< .001
Peripheral vasculopathy	314 (22.5)	0	0	0	< .001
Cerebrovascular disease	160 (11.5)	0	0	0	< .001
Severe kidney disease	136 (9.8)	0	0	0	< .001
Heart failure	160 (11.5)	0	0	0	< .001
Pulmonary disease	258 (18.5)	148 (10.3)	14 (9.7)	19 (10.3)	< .001
<i>Previous treatment</i>					
Antiplatelets/anticoagulants	971 (69.7)	179 (12.4)	9 (6.3)	4 (2.2)	< .001
Beta-blockers	611 (43.9)	128 (8.9)	6 (4.2)	0	< .001
ACEIs/ARBs	852 (61.2)	507 (35.2)	4 (2.8)	1 (0.5)	< .001
<i>Clinical presentation</i>					
Initial heart rate, bpm	80 (66-96)	77 (65-90)	74 (64-87)	73 (60-88)	< .001
Initial systolic blood pressure, mmHg	140 [120-160]	140 [120-160]	142 [125-158]	140 [122-154]	.717
Killip class > 2	251 (18.0)	114 (7.9)	3 (2.1)	7 (3.8)	< .001
Persistent ST elevation	564 (44.2)	910 (64.2)	95 (68.3)	122 (67.4)	< .001
ST-segment/T wave alterations	1158 (90.7)	1311 (92.5)	130 (93.5)	173 (95.6)	.008
Positive markers	1339 (96.2)	1416 (98.1)	142 (98.6)	182 (98.9)	.001
Initial blood glucose, mg/dL	173 [125-244]	124 [106-153]	124 [107-150]	131 [109-151]	< .001
eGFR < 30 mL/min/1.73 m ²	116 (8.3)	0	0	0	< .001
GRACE score	146 [119-177]	119 [96-145]	120 [101-136]	122 [103-142]	< .001

ACEIs, angiotensin-converting enzyme inhibitors; ARBs, angiotensin II receptor blockers; eGFR, estimated glomerular filtration rate; GRACE, Global Registry of Acute Coronary Events.

Patients were considered to have a cardiovascular risk factor if this diagnosis was recorded in the electronic medical records or if they received treatment to manage a risk factor or reported having been diagnosed with the risk factor in question. Severe kidney disease is defined as creatinine values > 2.0 mg/dL or history of dialysis or kidney transplant. Pulmonary disease is defined as a lung disease that requires chronic treatment or induces a functional limitation.

Data are expressed as No. (%) or median [interquartile range].

Table 2
Baseline lipid-lowering therapy and cholesterol levels at admission in 4 groups of patients according to their baseline cardiovascular risk

	Very high risk (n = 1393)	High risk (n = 1443)	Isolated dyslipidemia (n = 144)	Low risk (n = 184)	P
<i>Lipid-lowering therapy</i>	985 (70.7)	304 (21.1)	47 (32.6)	0	< .001
<i>Statin therapy</i>	949 (68.1)	280 (19.4)	45 (31.3)	0	< .001
<i>Combination lipid-lowering therapy</i>	60 (4.3)	4 (0.3)	3 (2.1)	0	< .001
<i>Cholesterol values at admission, mg/dL</i>					
Total cholesterol	156 [131-184]	188 [162-217]	196 [171-219]	181 [159-211]	< .001
LDL-C	87 [66-111]	115 [93-139]	122 [101-141]	114 [89-137]	< .001
HDL-C	38 [32-44]	39 [34-46]	43 [36-51]	43 [36-51]	< .001
LDL-C below the recommended target	401 (28.8)	460 (31.9)	58 (40.3)	164 (89.1)	< .001
LDL-C not exceeding more than 25% of the recommended target	698 (50.1)	876 (60.7)	113 (78.5)	184 (100)	< .001
LDL-C not exceeding more than 50% of the recommended target	965 (69.3)	1185 (82.1)	133 (92.4)	184 (100)	< .001

HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein-cholesterol.

Data are expressed as No. (%) or median [interquartile range].

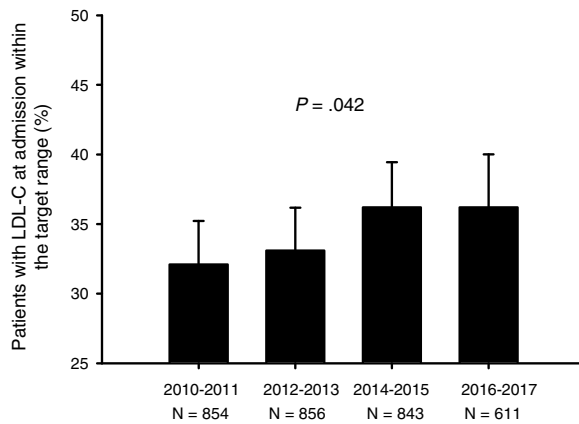


Figure 2. Changes over time (according to year of admission) in the percentage of patients with LDL-C levels at admission within the recommended target range. Error bars illustrate the upper limit of the 95% confidence interval. LDL-C, low-density lipoprotein-cholesterol.

Lipid control in patients with stable ischemic heart disease

Most studies evaluating the degree of lipid control have focused on stable patients. In recent surveys conducted in Europe or in other regions around the world, the percentage of patients with stable coronary heart disease and LDL-C concentrations < 70 mg/dL ranged between 7% and 30%.^{15,16,19,20} In studies restricted to patients being treated with statins, with or without documented cardiovascular disease, optimal control percentages ranged from 27% to 52%.^{13,14,17} In Spain, analysis of the Spanish cohort of one of these last studies obtained results that were in line with the general figures.²⁴ In addition, also in Spain, LDL-C percentages within the target range were recently reported in 26% of 1103 patients with stable coronary heart disease²⁵ and in 41.5% of 392 young people with familial hypercholesterolemia.¹⁸

Baseline lipid control in patients admitted for acute coronary syndrome

Although inadequate lipid control has been associated with a higher incidence of ACS,^{5,6,8,26} dyslipidemia has often been

Table 3

Baseline characteristics of patients with LDL-C levels at admission within or above the recommended limits

	LDL-C within recommended limits (n = 1083)	LDL-C above recommended limits (n = 2081)	P
Age, y	67 [55-76]	63 [53-75]	< .001
Women	272 (25.1)	485 (23.3)	.258
Body mass index \geq 25	640 (68.6)	1333 (74.5)	.001
Risk factors, %			
Active smoking	279 (25.9)	913 (43.9)	< .001
Hypertension	657 (60.7)	1,307 (62.9)	.226
Diabetes mellitus	278 (25.7)	661 (31.8)	< .001
Dyslipidemia	554 (51.2)	1342 (64.6)	< .001
History and comorbidities			
Ischemic heart disease	234 (21.6)	447 (21.5)	.934
Peripheral vasculopathy	107 (9.9)	207 (9.9)	.952
Cerebrovascular disease	54 (5.0)	106 (5.1)	.896
Severe kidney disease	59 (5.4)	77 (3.7)	.021
Initial eGFR < 60 mL/min/1.73 m ²	274 (25.3)	411 (19.8)	< .001
Heart failure	54 (5.0)	106 (5.1)	.896
Pulmonary disease	162 (15.0)	277 (13.3)	.203
Previous treatment			
Antiplatelets/anticoagulants	430 (39.7)	733 (35.2)	.013
Beta-blockers	269 (24.8)	476 (22.9)	.222
ACEIs/ARBs	471 (43.5)	893 (42.9)	.764
Oral antidiabetic agents/insulin	260 (24.0)	585 (28.1)	.013
Statins	471 (43.5)	803 (38.6)	.008
Lipid-lowering therapy	488 (45.1)	848 (40.8)	.020
Estimated cardiovascular risk			
			< .001
Very high risk	401 (37.0)	992 (47.7)	
High risk	460 (42.5)	983 (47.2)	
Isolated dyslipidemia	58 (5.4)	86 (4.1)	
Low risk	164 (15.1)	20 (1.0)	

ACEIs, angiotensin-converting enzyme inhibitors; ARBs, angiotensin II receptor blockers; eGFR, estimated glomerular filtration rate; LDL-C, low-density lipoprotein-cholesterol.

Patients were considered to have a cardiovascular risk factor if this diagnosis was recorded in the electronic medical records or if they received treatment to manage a risk factor or reported having been diagnosed with the risk factor in question. Severe kidney disease is defined as creatinine values > 2.0 mg/dL or history of dialysis or kidney transplant. Pulmonary disease is defined as a lung disease that requires chronic treatment or induces a functional limitation.

Data are expressed as No. (%) or median [interquartile range].

Table 4
Independent predictors of inadequate LDL-C control

Variable	OR (95%CI)	P
Dyslipidemia	2.43 (1.98-2.98)	<.001
Active smoking	2.32 (1.93-2.78)	<.001
Diabetes mellitus	1.68 (1.38-2.04)	<.001
Ongoing statin therapy	0.50 (0.40-0.62)	<.001
Body mass index \geq 25	1.36 (1.13-1.63)	.001

95%CI, 95% confidence interval; LDL-C, low-density lipoprotein-cholesterol; OR, odds ratio.

considered as a dichotomous variable and few studies have analyzed the degree of baseline lipid control in patients admitted for ACS. In a large North American registry that included patients admitted for stable or unstable coronary disease between 2000 and 2006, 17.6% of the 136 905 patients whose LDL-C was measured (59% of the total) had levels $<$ 70 mg/dL.¹² Recently, the DYSIS-II registry²⁷ included, in addition to patients with stable coronary disease, 3867 patients admitted for ACS in 2012 and 2013 in hospitals from 18 countries in Asia, Europe, and the Middle East; 18.9% had LDL-C concentrations at admission $<$ 70 mg/dL. Finally, in a Greek study of 687 patients with ACS, patients with LDL-C concentrations in line with the recommended targets comprised less than 20% of the highest risk groups and between 30% and 40% of the lowest risk groups.²⁸

This study provides contemporary information on the degree of LDL-C control in unselected patients admitted for ACS in Spain. No data had been available on this topic because Spanish hospitals were not involved in the DYSIS-II study. Compared with the studies mentioned, the proportion of patients with LDL-C levels within the recommended target range was higher in the present study, but still insufficient. Some data provide hope that the situation will improve. First, and in line with other registries,^{12,29,30} there was an increase, although small, in the proportion of patients with optimal lipid control in recent years. Second, the percentage of patients with extreme deviations from the target was relatively low. Finally, the lipid-lowering therapy was far from optimal in a considerable number of patients. As already observed,^{5,7,13,19,27} the percentage of patients with adequate LDL-C concentrations should be significantly increased by a more aggressive drug therapy based on the prescription of appropriate doses of potent statins to patients with high or very high risk, close analytical monitoring, and the use of combination therapies when monotherapy is insufficient. Lipid control can be improved with simple interventions,^{31,32} which must be maintained over time to avoid loss of treatment adherence among patients.³³

Predictors of inadequate lipid control

The degree of LDL-C control was inversely associated with the patients' cardiovascular risk. This association, consistent with previous observations,^{14,17,28} is partly because the targets are more stringent for patients with higher risk, although it may also be more difficult for these patients to achieve strong and persistent LDL-C reductions due to worse adherence to treatments and healthy lifestyles or for other reasons. Specifically, poor LDL-C control was independently associated with dyslipidemia, smoking, diabetes, and excess weight, whereas statin therapy was associated with better control. These results also partly agree with previous observations,^{12–14,18,27} although diabetes has been associated with better lipid control in some studies.^{12,25,27} The results identify a subgroup of patients (with excess weight or these other risk factors) that warrant priority attention.

Methodological considerations and limitations

Although the patients were enrolled from a single center, their origin was diverse, not only because they belonged to the large catchment area of our hospital, but also because many patients admitted in line with the infarction code program came from remote regions. On the other hand, the series was large and includes almost as many patients with ACS as the largest multinational study published to date.²⁷ Thus, the results are probably representative of the population of our country.

The lipid control targets were based on cardiovascular risk stratification of the patients according to the applicable European guidelines.^{10,11} Although, the treatment guidelines for dyslipidemia of 2011 were in force during most of the analyzed period,⁹ these recommendations were ambitious because they considered all patients with type 2 diabetes or moderate renal dysfunction as being at very high risk (with an LDL-C target $<$ 70 mg/dL). Given that these targets were substantially reduced in subsequent guidelines and that there is a delay between recommendation publication and implementation, we believe that the current targets provide a more realistic and up-to-date view of patients' lipid control.

As mentioned, we decided not to exclude patients admitted on Friday and Saturday—most of whom did not undergo an analysis within the first 24 hours of admission—after verifying that their exclusion did not modify the results. This observation contrasts with some previous findings³⁴ but is in line with those of the largest relevant study, which showed that LDL-C values do not vary significantly during ACS admission.³⁵ In our study, low LDL-C values at admission were associated with worse clinical presentation and higher hospital mortality. This association may have influenced the results and indicates that, in the most severe patients, the LDL-C values at admission are probably not representative of the degree of prior control. Finally, a limitation in the available data prevented calculation of the 10-year cardiovascular risk and analysis of the association of the degree of lipid control with potential variables of interest, such as the patients' psychological profile, therapeutic adherence, and statin potency or dose.

CONCLUSIONS

Most patients admitted for ACS in Spain have high or very high cardiovascular risk and just over a third have LDL-C levels at admission within the recommended target range. Adequate LDL-C control is inversely related to patient risk. Dyslipidemia, smoking, diabetes, and excess weight are independent predictors of inadequate lipid control and identify a subgroup of patients with priority need for improved outpatient lipid control and general cardiovascular prevention.

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CONFLICTS OF INTEREST

JA Barrabés has received fees from AstraZeneca and Menarini for educational activities and from Bayer for consulting. RM Lidón has received fees from Ferrer Laboratories for consulting. The remaining authors have not declared conflicts of interest.

WHAT IS KNOWN ABOUT THE TOPIC?

- Dyslipidemia is common in patients with ACS. The LDL-C control of patients with stable ischemic heart disease is suboptimal, but there are few data on the degree of baseline lipid control of patients admitted for ACS and on the predictors of inadequate control in this population.

WHAT DOES THIS STUDY ADD?

- Just over a third of patients admitted for ACS in Spain have LDL-C levels at admission within the recommended target range, a proportion that has tended to slightly improve in recent years. Excess weight and the coexistence of other risk factors are independent predictors of inadequate lipid control. Patients with these characteristics warrant priority attention to improve LDL-C control and decrease cardiovascular risk.

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