

ORIGINAL ARTICLE

Prevalence of atherogenic dyslipidemia in primary care patients at moderate-very high risk of cardiovascular disease. Cardiovascular risk perception



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KEYWORDS

Dyslipidemia;
Risk factors;
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Abstract

Introduction: Atherogenic dyslipidemia is an important risk factor for cardiovascular disease. We aim to determine atherogenic dyslipidemia prevalence in primary care patients at moderate-very high cardiovascular risk and its associated cardiovascular risk perception in Spain.

Methods: This cross-sectional study included 1137 primary care patients. Patients had previous cardiovascular disease, diabetes mellitus, SCORE risk ≥ 3 , severe hypertension or dyslipidemia. Atherogenic dyslipidemia was defined as low HDL-C (<40 mg/dL [males], <50 mg/dL [females]) and elevated triglycerides (≥ 150 mg/dL). A visual analog scale was used to define a perceived cardiovascular disease risk score.

Results: Mean age was 63.9 ± 9.7 years (64.6% males). The mean BMI was 29.1 ± 4.3 kg/m², and mean waist circumference 104.2 ± 12.7 cm (males), and 97.2 ± 14.0 cm (females). 29.4% were smokers, 76.4% had hypertension, 48.0% were diabetics, 24.7% had previous myocardial infarction, and 17.8% peripheral arterial disease. European guidelines classified 83.6% at very high cardiovascular risk. Recommended HDL-C levels were achieved by 50.1% of patients and 37.3% had triglycerides in the reference range. Target LDL-C was achieved by 8.8%. The overall atherogenic dyslipidemia prevalence was 27.1% (34.1% in diabetics). This prevalence in patients achieving target LDL-C was 21.4%. Cardiovascular risk perceived by patients was 4.3/10, while primary care physicians scored 5.7/10.

Conclusions: When LDL-C levels are controlled, atherogenic dyslipidemia is more prevalent in those patients at highest cardiovascular risk and with diabetes. This highlights the importance of intervention strategies to prevent the residual vascular risk in this population. Both patients and physicians underestimated cardiovascular risk.

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PALABRAS CLAVE

Dislipidemia;
Factores de riesgo;
Atención primaria;
Colesterol
high-density
lipoprotein;
Triglicéridos

Prevalencia de dislipidemia aterogénica en pacientes de atención primaria en España con riesgo de enfermedad cardiovascular de moderado a muy alto. Percepción del riesgo cardiovascular

Resumen

Introducción: La dislipidemia aterogénica representa un factor de riesgo importante de enfermedad cardiovascular. Se pretende determinar la prevalencia de dislipidemia aterogénica en pacientes de atención primaria con riesgo cardiovascular de moderado a muy alto y la percepción de riesgo cardiovascular asociado en España.

Métodos: Estudio transversal que incluyó 1.137 pacientes de atención primaria. Los pacientes presentaban enfermedad cardiovascular previa, diabetes mellitus, SCORE ≥ 3 , hipertensión arterial severa o dislipidemia. La dislipidemia aterogénica se definió como C-HDL bajo (<40 mg/dL [hombres], <50 mg/dL [mujeres]) y triglicéridos elevados (≥ 150 mg/dL). Para definir la puntuación de percepción de riesgo de enfermedad cardiovascular se utilizó una escala visual analógica.

Resultados: La edad media fue de $63,9 \pm 9,7$ años (64,6% hombres). El IMC promedio fue de $29,1 \pm 4,3$ kg/m², y la media del perímetro de la cintura de $104,2 \pm 12,7$ cm (hombres) y $97,2 \pm 14,0$ cm (mujeres); el 29,4% eran fumadores, el 76,4% hipertensos, el 48,0% diabéticos, el 24,7% tenían antecedentes de infarto de miocardio y el 17,8% enfermedad arterial periférica. El 83,6% se clasificaron como pacientes de muy alto riesgo cardiovascular según las guías europeas. El 50,1% de los pacientes alcanzaron los niveles recomendados de C-HDL y el 37,3% tenían los triglicéridos dentro del rango. El 8,8% consiguieron niveles objetivo de C-LDL. La prevalencia general de dislipidemia aterogénica fue del 27,1% (34,1% en diabéticos). Esta prevalencia en los pacientes que alcanzaron niveles objetivo de C-LDL fue del 21,4%. El riesgo cardiovascular percibido por los pacientes fue de 4,3/10, mientras que sus médicos de atención primaria puntuaron un 5,7/10.

Conclusiones: Cuando se controlan los niveles de C-LDL la dislipidemia aterogénica es más prevalente en aquellos pacientes con mayor riesgo cardiovascular y diabéticos, lo que pone de manifiesto la importancia de las estrategias de intervención para prevenir el riesgo vascular residual en esta población. Tanto pacientes como médicos subestimaron el riesgo cardiovascular. © 2014 Sociedad Española de Arteriosclerosis. Publicado por Elsevier España, S.L.U. Todos los derechos reservados.

Introduction

Atherogenic dyslipidemia involves decreased levels of high-density lipoprotein cholesterol (HDL-C) and increased triglycerides¹ and is associated to qualitative alteration in low-density lipoprotein cholesterol (LDL-C) which are smaller and denser. This condition has been associated to increased cardiovascular risk and is perceived as highly prevalent in the primary care setting. It is typically seen in patients with obesity, metabolic syndrome, insulin resistance, and type 2 diabetes mellitus (type 2 DM).^{2,3} While several epidemiological studies have examined the prevalence of lipid abnormalities, most have focused only on total cholesterol (TC) levels. A large study conducted in 2006 on working people undergoing routine check-up in Spain obtained a prevalence of dyslipidemia of 64% (TC ≥ 200 mg/dL, LDL-C ≥ 160 mg/dL, triglycerides ≥ 200 mg/dL, or HDL-C $<40/50$ mg/dL), and TC ≥ 240 mg/dL of 15%.⁴ Vegazo et al. in the same year found that one out of four patients who attended outpatient clinics of the Spanish health service had been diagnosed with dyslipidemia without diagnostic specific reference levels specified.⁵ Results of a metaanalysis including 47 cross-sectional studies in Spain published between 1990 and 2003 on the main cardiovascular risk factors prevalence showed that 23% of middle-aged adults had TC ≥ 250 mg/dL and 50–60% had TC

≥ 200 mg/dL.⁶ In line with these results, a more recent study on 11,554 patients conducted in Spain found that about 50% had hypercholesterolemia (TC ≥ 200 mg/dL or drug treatment).⁷

Numerous studies have shown a continued and gradual relationship between serum cholesterol, mainly LDL-C, and total mortality due to ischemic heart disease,^{8–14} as well as the association of LDL-C reductions and European guidelines recommend LDL-C below 100 or 70 mg/dL for high and very high cardiovascular risk patients.

Moreover despite obtaining LDL-C targets, the number of new events remains inappropriately high. This situation is referred to residual cardiovascular risk and, apart from non-lipid conditions, lipoprotein alterations beyond LDL-C concentrations could have a role, particularly low HDL-C and high triglycerides (atherogenic dyslipidemia). Two subgroup analyses of two studies identify atherogenic dyslipidemia subgroup as a group of patients that could obtain benefit of correcting the lipoprotein abnormalities,^{15,16} suggesting that a good global control of dyslipidemia is essential in prevention of cardiovascular disease. The objective of this study was to assess the prevalence of atherogenic dyslipidemia among adult patients at moderate to high cardiovascular risk seen in primary care, and to examine grade of control on serum lipid components and patients' and physicians' perceptions of cardiovascular risk.

Patients and methods

This was an epidemiological, cross-sectional and multicenter study conducted in Spanish population with moderate to very high cardiovascular risk. Patients were consecutively selected from primary care centers between June 2011 and November 2011 with the participation of 432 investigators. The investigators and sites were selected from every Spanish region ensuring the representativeness of each one, weighting the population size of each region and balancing the civic and rural origin as well as the proportion between southern and northern regions. The study included patients ≥ 18 years of age who fulfilled at least one of the following criteria 1: previous cardiovascular disease (coronary event, cerebrovascular event or peripheral arterial disease); (2) type 2 DM or type 1 DM with microalbuminuria; (3) hypertension, dyslipidemia, smoking or other risk factors (Systematic Coronary Risk Evaluation [SCORE] risk ≥ 3); or (4) severe forms of hypertension or dyslipidemia (hypertension stage 2–3, LDL-C >190 mg/dL, triglycerides >500 mg/dL). Exclusion criteria were patients with chronic inflammatory diseases, neoplastic diseases, hepatic cirrhosis or alcohol abuse and thyroid disease. The study was approved by the Ethics Committee of Hospital Clínic (Barcelona, Spain), and all enrolled patients provided signed informed consent.

The variables collected included anthropometric and sociodemographic data (age, gender, menopausal status, weight, height, body mass index, and waist circumference), blood pressure, SCORE, and clinical history at study inclusion (hypertension, diabetes mellitus, hyperlipidemia, cardiovascular disease, microalbuminuria and other relevant diseases). Participants were also interviewed to determine their smoking, alcohol and exercise habits. Laboratory determinations included: TC, triglycerides, HDL-C, LDL-C, non-HDL-C, blood glucose and hemoglobin A1c levels. Perception of cardiovascular risk, either in patient and the physician, was given by marking a 100 mm visual analog scale from 0 (absence of risk) to 100 (maximum risk). Data were also recorded on whether the patient was taking any lipid-modifying drugs without specifying the medication.

Cardiovascular risk was considered to be moderate if SCORE $\geq 1\%$ to $\leq 5\%$, high if SCORE $>5\%$ to $<10\%$ or DM without other risk factors, and very high when patients had a SCORE $>10\%$, DM with microalbuminuria or associated risk factors, or previous cardiovascular disease (coronary event, cerebrovascular event, peripheral arterial disease). Atherogenic dyslipidemia was defined by high triglyceride levels (>150 mg/dL) and low HDL-C (<40 in men and <50 mg/dL in women). LDL-C was assumed to be well-controlled if the LDL-C was <115 mg/dL, <100 mg/dL and <70 mg/dL in moderate, high, and very high risk patients, respectively. Considering that 5% of the patients included initially would not be valid for the final analysis, the sample size was estimated to be 1728 patients (alpha error: 0.05%; precision: 2.1%) to calculate the prevalence of dyslipidemia based on the data of mix hiperlipidemia of 25.7% reported by Vegazo et al.⁵ Quantitative variables were analyzed with measures of central tendency (mean, median) and dispersion (standard deviation, 25th percentile, 75th percentile, minimum, and maximum). Qualitative variables were studied with frequencies and percentages of each of the possible

Table 1 Socio-demographic and clinical characteristics of the evaluable patients.

Patients (N=1137/100%)	CI (95%)	
Age (years) (mean $\pm$ SD)	63.9 $\pm$ 9.7	63.3–64.5
Men (N/%)	734/64.6	61.7–67.3
Smoking (N/%)	334/29.4	26.7–32.1
Former smoking (N/%)	350/30.8	28.1–33.6
BMI (kg/m ²) (mean $\pm$ SD)	29.1 $\pm$ 4.3	28.8–29.4
Men: waist circumference (cm) (mean $\pm$ SD)	104.2 $\pm$ 12.7	103.2–105.2
Women: waist circumference (cm) (mean $\pm$ SD)	97.2 $\pm$ 14.0	95.6–98.8
Hypertension (N/%)	869/76.4	73.9–78.9
SBP (mmHg) (mean $\pm$ SD)	140.5 $\pm$ 17.3	139.5–141.5
DBP (mmHg) (mean $\pm$ SD)	81.3 $\pm$ 10.8	80.6–82.0
Treated for hypertension (N/%)	824/94.8	93.1–96.2
DM (N/%)	546/48.0	45.1–51.0
Type 2 DM (N/%)	490/43.1	40.2–46.0
Glucose (mg/dL) (mean $\pm$ SD)	140.6 $\pm$ 45.8	136.7–144.5
Hb1Ac (%) (mean $\pm$ SD)	7.2 $\pm$ 1.2	7.1–7.3
Treated for Type 2 DM (N/%)	466/95.1	92.8–96.8

BMI, body mass index; CI, confidence interval; DBP, diastolic blood pressure; DM, diabetes mellitus; SBP, systolic blood pressure.

responses. The 95% confidence interval (CI) was calculated for the variables of interest. Means were compared with the Student's *t* test for independent data. Quantitative data that did not follow a normal distribution were analyzed with the Mann–Whitney non-parametric test, and possible associations between the qualitative variables were studied with the χ^2 test. Multiple logistic regression analysis was performed to quantify the association between cardiovascular risk perceived by patients and each of the cardiovascular risk factors. Correlation indexes to assess the patient's perception of the risk and the clinical objectives (Pearson or Spearman depending on variable distribution) were calculated. A *p*-value less than 0.05 was considered significant. All analyses were performed with the Statistical Package for the Social Sciences (SPSS) version 17.

Results

Patient characteristics

Of the 1322 patients enrolled in the present study, 185 were excluded for unmet selection criteria, resulting in a final sample of 1137 evaluable patients. Table 1 shows the most relevant sociodemographic and clinical characteristics of the included patients.

As shown in Table 2, myocardial infarction was the most frequently suffered coronary event (24.7%). Previous cerebrovascular events (transitory ischemic attack and stroke) were reported by less than 10% of patients and 17.8%

Table 2 Determinants of cardiovascular risk level of study patients.

Patients (N = 1137/100%)	N/%	CI (95%)
Very high CVR due to CVD	741/65.2	62.3–68
Myocardial infarction (N/%)	281/24.7	22.2–27.3
Angina (N/%)	210/18.5	16.3–20.8
CABG (N/%)	73/6.4	5.1–8.0
PTCA (N/%)	168/14.8	12.8–17.0
TIA (N/%)	93/8.2	6.7–9.9
Stroke (N/%)	95/8.4	6.8–10.1
Peripheral arterial disease (N/%)	202/17.8	15.6–20.1
Diabetic patients W/O associated risk factors	546/48	45.1/51.0
SCORE (mean $\pm$ SD)	5.7 $\pm$ 6.3	5.3–6.1
SCORE $\geq 1\%$ to $\leq 5\%$ (N/%)	630/55.4	52.5–58.3
SCORE $> 5\%$ to $< 10\%$ (N/%)	197/17.3	15.2–19.7
SCORE $\geq 10\%$ (N/%)	147/12.9	11.0–15.0

CABG, coronary artery bypass graft; CI, confidence interval; PTCA, percutaneous transluminal coronary angioplasty; TIA, transitory ischemic attack.

had peripheral arterial disease. Approximately half of the patients had SCORE $\geq 1\%$ to $\leq 5\%$. Nevertheless, 83.6% of all patients were classified as having very high cardiovascular risk.

Control of lipid parameters

Percentages of patients with controlled levels for each lipoprotein component according to their cardiovascular risk are presented in Table 3. Target LDL-C levels were achieved in 8.8% of all patients (Table 3). However, LDL-C control was much lower in patients with high or very high cardiovascular risk and among those with cardiovascular events or DM, without exceeding 10% in any case. Overall, there was a higher percentage of patients achieving recommended levels of triglycerides (< 150 mg/dL) and HDL-C (> 40 – 50 mg/dL), although in most cases less than half of the patients were controlled. In addition, the secondary goal for non-HDL-C (< 130 mg/dL) was only achieved by 5.4%, 2.3% and 4.6% of very high, high and moderate risk patients, respectively.

Atherogenic dyslipidemia prevalence

The overall prevalence of atherogenic dyslipidemia (triglycerides > 150 mg/dL and HDL-C < 40 mg/dL in men, < 50 mg/dL in women) was 27.1% (CI: 24.5–29.8). Most of the patients were treated for high triglycerides and LDL-C (mean TG levels of 196.5 ± 129.5 mg/dL and mean LDL-C levels 131.2 ± 58.6 mg/dL). Nevertheless, HDL-C values were within the recommended range (47.3 ± 17.6 mg/dL in men and 50.7 ± 19.1 mg/dL in women) and overall less than half of the patients received treatment for increasing HDL-C levels (Table 4).

Table 3 Control of lipid parameters in the study patients according to their cardiovascular risk.

	LDL-C on target ^a		Recommendations for triglycerides and HDL			
	N/%	CI (95%)	Triglycerides < 150 mg/dL		HDL-C > 40 – 50 mg/dL	
	N/%	CI (95%)	N/%	CI (95%)	N/%	CI (95%)
Total patients (N = 1137)	100/8.8	7.3–10.6	424/37.3	34.5–40.2	570/50.1	47.2–53.1
Moderate risk ^b (N = 109)	40/36.7	27.7–46.5	26/23.9	16.2–33.0	50/45.9	36.3–55.7
High risk ^b (N = 43)	3/7.0	1.5–19.1	12/27.9	15.3–43.7	19/44.2	29.1–60.1
Very high risk ^b (N = 951)	68/7.2	5.6–9.0	378/39.7	36.6–42.9	481/50.6	47.4–53.8
Previous coronary event ^c (N = 495)	42/8.5	6.2–11.3	229/46.3	41.8–50.8	269/54.3	49.8–58.8
Previous cerebrovascular event ^d (N = 173)	11/6.4	3.2–11.1	59/34.1	27.1–41.7	78/45.1	37.5–52.8
Peripheral arterial disease (N = 202)	15/7.4	4.2–12.0	72/35.6	29.0–42.7	108/53.5	46.3–60.5
Type 2 diabetes mellitus (N = 490)	44/9.0	6.6–11.9	170/34.7	30.5–39.1	228/46.5	42.0–51.1
Type 1 diabetes mellitus + microalbuminuria (N = 23)	1/4.3	0.1–21.9	16/69.6	47.1–86.8	15/65.2	42.7–83.6
Hypertension (N = 869)	226/26.0	23.1–29.1	317/36.5	33.3–39.8	434/49.9	46.6–53.3

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

^a LDL-C on target depending of global cardiovascular risk of the patients: moderate risk: LDL-C < 115 mg/dL; high risk: LDL-C < 100 mg/dL; very high risk: LDL-C < 70 mg/dL.

^b Moderate risk was considered when SCORE $\geq 1\%$ to $\leq 5\%$; high risk was considered when SCORE $> 5\%$ to $< 10\%$; very high risk patients were considered those with SCORE $\geq 10\%$ or presence of type 2 DM, type 1 DM (with microalbuminuria), presence of a previous coronary event or cerebrovascular event or peripheral arterial disease.

^c Myocardial infarction, angina, coronary artery bypass graft or percutaneous transluminal coronary angioplasty.

^d Including transitory ischemic attack or stroke.

Table 4 Characteristics of the dyslipidemia.

Patients (N = 1137/100%)	CI (95%)	
Patients with lipid disorders (N/%)	951/83.6	81.4–85.7
TC (mg/dL) (mean ± SD)	210.8 ± 50.9	207.8–213.8
LDL-C (mg/dL) (mean ± SD)	131.2 ± 58.6	127.6–134.8
Patients treated for high LDL-C (N/%)	783/68.9	66.1–71.5
Men: HDL-C (mg/dL) (mean ± SD)	47.3 ± 17.6	46.0–48.7
Women: HDL-C (mg/dL) (mean ± SD)	50.7 ± 19.1	48.7–52.7
Patients treated for low HDL-C (N/%)	531/46.7	43.8–49.7
Triglycerides (mg/dL) (mean ± SD)	196.5 ± 129.5	199.9–204.1
Patients treated for high triglycerides (N/%)	660/58.0	55.1–60.9
Non-HDL-C (mg/dL) (mean ± SD)	130.7 ± 72.2	119.5–141.9

CI, confidence interval; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; TC, total cholesterol.

Prevalence of atherogenic dyslipidemia in the study groups according to their cardiovascular risk was also assessed (Table 5). Prevalence ranged from 26.1% in very high risk patients to 34.9% in moderate risk patients. Table 5 also shows that the prevalence of dyslipidemia in patients with LDL-C on target was 21.4% (CI: 16.9–26.5). The highest rates were reported in high risk patients (66.7%) and type 2 DM patients (40.9%).

Perception of cardiovascular risk

Overall, physicians' subjective perception of cardiovascular risk on 10 point visual analog scale was slightly higher than patients' perception (5.7 and 4.3, respectively). A significant positive correlation was found between patients' and physicians' perceived risk of cardiovascular disease and their actual calculated risk based on SCORE ($p \leq 0.002$). Moreover, patients' perception of cardiovascular risk correlated positively with systolic ($r = 0.107$, $p = 0.001$) and diastolic blood pressure values ($r = 0.065$, $p = 0.042$), and negatively with non-HDL-C levels ($r = -0.45$, $p = 0.002$). As shown in Fig. 1, patients with dyslipidemia, previous CVD and DM risk perceived a higher cardiovascular risk in comparison with patients not having these diseases. Cardiovascular risk perceived by physicians also differed significantly between presence and absence of dyslipidemia, previous CVD, DM and hypertension in study patients. In a multivariate analysis only the presence of established cardiovascular disease as a risk factor was independently associated with higher

Table 5 Prevalence of atherogenic dyslipidemia in the study populations according to their cardiovascular risk.

	Overall atherogenic dyslipidemia in the study population ^a			Atherogenic dyslipidemia in patients with LDL-C on target ^b	
	N/%	CI (95%)		N/%	CI (95%)
Total patients (N = 1137)	308/27.1	24.5–29.8		64/21.4	16.9–26.5
Moderate risk ^c (N = 109)	38/34.9	26.0–44.6	Moderate risk ^c (N = 40)	10/25.0	12.7–41.2
High risk ^c (N = 43)	12/27.9	15.3–43.7	High risk ^c (N = 3)	2/66.7	9.4–99.2
Very high risk ^c (N = 951)	248/26.1	23.3–29.0	Very high risk ^c (N = 68)	20/29.4	19.0–41.7
Previous coronary event ^d (N = 495)	108/21.8	18.3–25.7	Previous coronary event ^d (N = 42)	12/28.6	15.7–44.6
Previous cerebrovascular event ^e (N = 173)	59/34.1	27.1–41.7	Previous cerebrovascular event (N = 11)	2/18.2	2.2–51.8
Peripheral arterial disease (N = 202)	51/25.2	19.4–31.8	Peripheral arterial disease (N = 15)	4/26.7	7.8–55.1
Type 2 diabetes mellitus (N = 490)	167/34.1	29.9–38.5	Type 2 diabetes mellitus (N = 44)	18/40.9	26.3–56.8
Type 1 diabetes mellitus + microalbuminuria (N = 23)	2/8.7	1.1–28.0	Type 1 diabetes mellitus + microalbuminuria (N = 1)	–	–

CI, confidence interval; LDL-C, low-density lipoprotein cholesterol.

^a Atherogenic dyslipidemia was considered when level of triglycerides >150 mg/dL plus HDL-C >40–50 mg/dL.

^b LDL-C on target was defined as LDL-C <115 mg/dL (moderate risk patients), LDL-C <100 mg/dL (high risk patients) and LDL-C <70 mg/dL (very high risk patients), except for the total population where LDL-C was considered to be on target if <100 mg/dL.

^c Moderate risk was considered when SCORE ≥1% to ≤5%; High Risk was considered when SCORE >5% to <10%; very high risk patients were considered those with SCORE ≥10% or presence of type 2 DM, type 1 DM (with microalbuminuria), presence of a previous coronary event or cerebrovascular event or peripheral arterial disease.

^d Myocardial infarction, angina, coronary artery bypass graft or percutaneous transluminal coronary angioplasty.

^e Transitory ischemic attack or stroke.

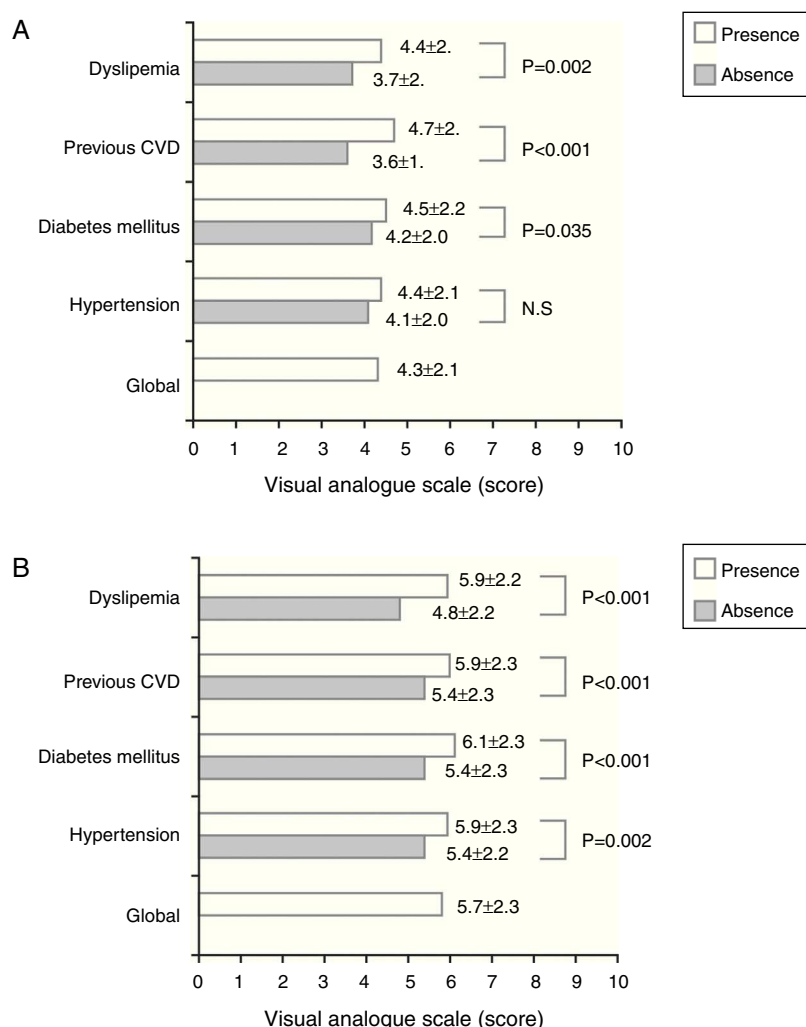


Figure 1 Perception of cardiovascular risk as measured in the Visual Analog Scale (A: patients' perception; B: physicians' perception). CVD, cardiovascular disease.

subjective perception of cardiovascular risk (OR = 11.0; 95%CI: 8.4–13.6).

Discussion

In our study, approximately half of the patients at moderate to very high cardiovascular risk had controlled levels of HDL-C and triglycerides, and one in four patients had low HDL-C and raised triglycerides simultaneously. Few studies have assessed the prevalence of AD among Spanish primary care patients at cardiovascular risk. Lahoz et al. reported a prevalence of 13% of patients with AD in a study involving 7823 subjects with established coronary artery disease.¹⁷ Of the participants, 26.3% had low HDL-C and 39.7% had elevated triglycerides. González-Juanatey et al. found a very similar prevalence of AD, close to 15%, in a Spanish population at high cardiovascular risk defined as having previous cardiovascular disease, DM and/or risk SCORE ≥ 5 .¹⁸ In our case low HDL-C was observed in 25.3% of patients and 37.8% had elevated triglycerides. Prevalence of AD reported in these two previous studies was lower than that of our study probably due to the participants' atherosclerotic profile,

and the elevated number of patients receiving lipid-lowering treatment (80.3% and 100% of patients, respectively). When compared to the abovementioned studies a higher rate of obesity, DM, lipid disorders and smokers was observed in our patients.

It is worth pointing out that the clinical characteristics of our patients suggested an elevated percentage of patients with metabolic syndrome, especially because of the high percentage of hypertensive patients, with abdominal obesity and impaired glucose tolerance. It is known that AD is typical of type 2 DM and one of the defining components of metabolic syndrome. In addition, patients with DM treated with statins often have relatively low levels of LDL-C but abnormal HDL-C and triglycerides, remaining at substantial risk of a cardiovascular event.^{19,20} Hermans et al. found a prevalence of AD of 35% in type 2 DM patients.²¹ This percentage is similar to that observed in our diabetic patients (30%) and rose to 41% in those patients with LDL-C on target. The fact that almost half of our study patients had DM along with the probable high rate of metabolic syndrome, this might also explain the overall high prevalence of AD observed in our population. Additionally, we found a high prevalence of poor control of LDL-C. Only

8.8% of patients had achieved the recommended targets. Several studies showed similar target achievement rates for this lipoprotein,^{18,22–24} and a worse control in patients with higher cardiovascular risk.¹⁸ Thus, our results corroborated that a high proportion of patients do not meet target levels of LDL-C, particularly in high-risk cases, even though therapy for AD is directed to first lowering serum LDL-C levels.

Previous studies have investigated the awareness and perception of patients and health professionals concerning the risk of cardiovascular events. As a novel aspect of the present study, we have examined risk perceptions among patients at moderate to high cardiovascular risk and their physicians using a visual analog scale. A significant, though weak, positive correlation was found between perceived risk of heart disease and estimated risk with SCORE charts. However, patients scored a mean of 5/10 regarding their perception of cardiovascular risk, and physicians did not score much higher (6.8/10). Considering that 83% of the population were classified as very high-risk patients (SCORE >10%, DM, previous CVD), these results indicate a low perception of cardiovascular risk, especially among the study patients. Despite using a different methodology, our findings are consistent with those of previous studies. Firstly, physicians tend to not use cardiovascular risk calculators^{25,26} and underestimate the absolute cardiovascular risk of their patients.^{27,28} Secondly, primary care patients often perceive cardiovascular risk inaccurately,^{29,30} and the bias tends to be toward inappropriate optimism,^{31,32} also in selected populations with established high risk of CVD.^{33–35} Furthermore, when we studied the influence of cardiovascular risk factors on perceived risk, multivariate logistic regression showed that only established CVD was significantly associated with a higher risk perception by study patients. In contrast, risk factors such as DM were not found to be an independent risk factor for cardiovascular events. A study evaluating the knowledge level of stroke risk factors among primary care patients found that DM had the lowest identification rate as a risk factor.³⁶ Other studies also showed a considerable percentage of patients who did not recognize this condition as a risk factor.^{37,38} This may lead to general underestimation of risk in our study population since a significant proportion of patients have DM.

In addition to detecting that a high percentage of patients did not achieve target levels of LDL-C, an important proportion of cases have low HDL-C and high triglycerides, even when LDL-C levels were controlled. Therefore, our results underscore the extent of the residual risk in the study population at high cardiovascular risk. Awareness of the percentage of patients presenting AD in this subgroup of patients is crucial, since pharmacological and life style intervention to raise HDL-C and lower triglycerides may help to reduce residual risk. Importantly, major cardiovascular events occur more frequently in patients with AD than in those with isolated high triglycerides and low HDL-C.³⁹ Our results also showed that a high number of patients with cardiovascular risk factors who may be eligible for prophylactic interventions to lower their risk are treated inadequately. Only about half of the patients were prescribed medicines to raise HDL-C or decrease triglycerides concentration. Possible explanations are low perception of cardiovascular risk by both patients and physicians. Subjective risk factor perception is an important component of the motivation to change

unhealthy life styles and comply with medical prevention strategies, so strategies are needed to improve perception of the actual risk for heart disease.

Our study did not reach the planned sample size but it was more than 1000 patients. The authors ignore if this fact may affect the prevalence calculation but recommend take caution when considering our results.

The cross-sectional nature of our study did not allow to infer causal relationships. Moreover, the potential to generalize our findings is limited due to possible selectivity bias; the selection of primary care centers and physicians was not randomized.

Responsabilidades éticas

Protección de personas y animales. Los autores declaran que para esta investigación no se han realizado experimentos en seres humanos ni en animales.

Confidencialidad de los datos. Los autores declaran que han seguido los protocolos de su centro de trabajo sobre la publicación de datos de pacientes y que todos los pacientes incluidos en el estudio han recibido información suficiente y han dado su consentimiento informado por escrito para participar en dicho estudio.

Derecho a la privacidad y consentimiento informado. Los autores declaran que en este artículo no aparecen datos de pacientes.

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Conflicts of interest

The authors state that Dr. Emilio Ferrer works for Ferrer International. Dr. Emilio Masana has collaborated with Ferrer International in advising for this article and with Laboratorios Dr. Esteve, Merck Sharp Dome, Danone, Sanofi aventis, Novartis as an advisor and/or performing presentations.

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Appendix A. Annex 1

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