RESEARCH

Cardiovascular Therapeutics

Differences in Medical Treatment of Chronic Coronary Heart Disease Patients According to Medical Specialities

Alberto Cordero,[1] Vicente Bertomeu-Martínez,[1] Pilar Mazón,[2] Juan Quiles,[1] Joaquín Aznar[3] & Héctor Bueno[4]

1 Hospital Universitario de San Juan, Alicante, Spain
2 Hospital de Santiago, A Coruña, Spain
3 Hospital Nuestra Señora de Gracia, Zaragoza, Spain
4 Hospital Gregorio Marañón, Madrid, Spain

Keywords
Comorbidities; Medical treatment; Risk factors control; Specialities.

Correspondence
Alberto Cordero, Departamento de Cardiología., Hospital Universitario de San Juan, Carretera Valencia-Alicante sn, 03550, San Juan de Alicante, Alicante, Spain.
Tel.: 965-938700;
Fax: 965-656268;
E-mail: acordero@coma.es

doi: 10.1111/j.1755-5922.2009.00093.x

Coronary heart disease (CHD) patients are currently attended by many different medical specialities. CHD patients must achieve the highest grade of treatment implementation and risk factors control. The aims were to describe differences in medical treatment of CHD according to the medical specialities. For this purpose we conducted an observational, cross-sectional, and multicenter study of CHD patients attended by internal medicine (IM), outpatient clinic cardiologist (OCC), hospital cardiologist (HC), and general practitioners (PC). Burden of noncardiac diseases was evaluated by the Charlson index. Joint prescription of antiplatelets, statins, beta-blockade agents and blockade of the renin–angiotensin system by angiotensin-converting enzyme inhibitors (ACEI) or angiotensin receptors blockers (ARB) was considered optimal medical treatment (OMT). A total of 2987 patients, mean age 67.4 (11.5) years and 71.5% males, were analyzed. Patients visited by IM physicians had slightly higher mean age and higher prevalence of hypertension, diabetes, and noncardiac diseases (median Charlson index 3.0, 1.0–5.0, vs. 2.0, 1.0–4.0, of total sample). OMT was prescribed in 25.9% (95% CI 25.6–26.2) of the patients and was statistically more frequently carried out by HC (32.1%) and OCC (29.0%) compared to IM (22.0%) and PC practitioners (21.5%). Multivariate analysis showed an independent association between OMT prescription and HC (OR 1.42; 95% CI 1.08–1.87) or OCC (OR 1.31; 95% CI 1.04–1.67); this association remained after including the Charlson index. Noncardiac diseases are the main clinical differences in CHD patients visited by different medical specialist although it does not explain the higher prescription of OMT by cardiologist.

Introduction

Coronary heart disease (CHD) patients are currently attended by many different medical specialities, such as internal medicine (IM), primary care (PC), or cardiology specialists [1–3]. Reduction of mortality of acute coronary syndromes [4–6] has contributed to a large increase of prevalence of patients with chronic CHD [7] in whom risk factors control and implementation of optimal medical treatment (OMT) is essential for prognosis improvement [8–11].

Medical management of cardiovascular diseases varies widely between different medical specialities. Management of acute coronary syndromes carried by cardiology specialists has been proved to be more compliant with medical guidelines and this conducted to lower mortality rates [1,12]. Relevant differences have also been described in chronic heart failure [13] although medical management of chronic CHD has not been largely studied. The low prescription of OMT in CHD patients can be explained by the presence of noncardiac diseases [14,15] but also by the differences in medical

management according to different specialities [1,3,16,17]. The TRECE (Tratamiento de la Enfermedad Coronaria en España/treatment of coronary heart disease in Spain) registry was designed to describe risk factors control and medical treatment of CHD patients; the present analysis describes differences in clinical features and medical treatments of CHD patients according to medical speciality where they are attended.

Material and Methods

Study Design

The TRECE registry was launched by the Spanish Society of Cardiology (working groups of hypertension, coronary heart disease, and clinical cardiology) as descriptive, cross-sectional, and multicenter study that involved practitioners nationwide. Twenty hospitals were randomly selected and 10 investigators were chosen: 50 cardiologists from outpatient clinics (OCC), 30 hospital cardiologists (HC), 20 internal medicine (IM) specialist and 100 general practitioners (GP). Throughout the first trimester of 2006 each practitioner included 15 consecutive patients with CHD; from these 3000 patients, 103 were excluded for lacking of precise diagnosis of CHD, so the final sample was constituted by 2897 patients.

Although this is an observational study without any intervention planned, the study protocol and informed consent was supervised and approved by the investigation agency of the Spanish Society of Cardiology and the ethics committee of the Hospital of San Juan (Alicante, Spain). Data collection was made in paper with a unified database designed by the study investigators.

Inclusion and Exclusion Criteria

The inclusion criteria were confirmed clinical diagnosis of chronic stable angina, typical chest pain with positive stress test or previous diagnosis of acute coronary syndrome, myocardial infarction, or unstable angina; patients could have more than one inclusion criteria. Exclusion criteria were denial of informed consent or incapacity to assure the diagnosis of CHD.

Prevalence, Control, and Treatment of Risk Factors

The antecedent of hypertension was registered when it was present in medical reports; two measurements of blood pressure were more than 140/90 mmHg or specific medical treatment was present; hypertension control was considered when blood pressure was less than 130/80 mmHg in two consecutive measurements [18]. The antecedent of dyslipidemia was reported when it had been previously diagnosed, confirmation of total cholesterol more than 220 mg/dL or low-density lipoproteins (LDL) more than 160 mg/dL or being under specific pharmacologic treatments; serum LDL less than 70 mg/dL was the threshold for LDL control [10]. Resting heart rate control was accepted when less than 70 bpm was registered in the physical examination or the electrocardiogram of the inclusion visit [19]. Previous diagnosis of diabetes mellitus, active medical treatments, or two determinations of fasting glucose more than 126 mg/dL were accepted, entering the antecedent of diabetes [20]. Glycated hemoglobin was not collected by protocol, so metabolic control of diabetes was only monitored by fasting glucose at the threshold of less than 108 mg/dL [20].

Obesity was registered when body mass index was more than 30 kg/m^2 and abdominal obesity when waist circumference was more than 102 cm in men or more than 88 cm in women [21]. Assessment of metabolic syndrome was made according to ATP-III definition when three of the five criteria were present in the same patient [21]. Glomerular filtration rate (GFR) was assessed by the abbreviated equation of the *Modification of Diet in Renal Disease Study* [22]: $(186 \times \text{creatinine}^{-1.154} \times \text{age}^{-0.203})$ $(\times 0.742$ in women).

All medical treatments and their doses before and after the inclusion visit were registered. Optimal medical treatment of CHD patients was considered by the joint prescription of antiplatelet agents, statins, beta-blockade agents, and blockade of the renin-angiotensin-aldosterone system by angiotensin-converting enzyme inhibitors (ACEI) or angiotensin receptors blockers (ARB) [8,10,11].

Comorbidities Assessment

Main clinical comorbidities were collected. The antecedent of atrial fibrillation (AF) was only accepted when if electrocardiogram evidence was available. Chronic obstructive pulmonary disease (COPD) was registered if such diagnosis was present in medical reports or if patients were under medical specific treatments. The global analysis of comorbidities was made by the Charlson index [23] adapted for patients with CHD [15]; this index included active smoking (1 point), hypertension (1 point), stroke (2 points), diabetes mellitus (2 points), COPD (2 points), peripheral arterial disease (2 points), and serum creatinine more than 3 mg/dL (7 points). According to previous reports [15], high comorbidity was considered when the index was $\geq$4.

Statistical Analysis

Data management was made with statistical package SPSS 15.0 (SPSS Inc, Chicago, IL). All variables, except triglycerides, had normal distribution so are presented as mean (standard deviation); mean comparisons were made with ANOVA test and Tukey *post hoc* analysis. Charlson index, a quantitative and discrete variable, and triglycerides were presented as median (interquartile range) and comparisons were analyzed by nonparametrical tests. Multivariate analysis was made by logistic regressions, adjusted by age and gender, and results were presented as odds ratio (OR; 95% confidence intervals, CI); categorical variables were grouped in dummies for logistic regressions. Statistical significance was accepted for $P < 0.05$.

Results

A total of 2897 CHD patients were recruited from OCC (992; 34.2%), GP (927; 32.0%), HC (591; 20.4%), and IM (387; 13.4%). Two-thirds of the population was included during scheduled visits (69.7%) and the rest from hospital admissions. Patients mean age was 67.4 (11.5) years and 71.5% were men; clinical characteristics and prevalence of risk factors are presented in Table 1. Patients attended by IM practitioners had slightly higher mean age and had the higher prevalence of hypertension and diabetes; patients attended by cardiologist had the higher prevalence of coronary revascularization.

Clinical characteristics obtained by physical and biochemical examinations were very much alike in all patients independently of the medical speciality where they were attended (Table 2); nevertheless, risk factor control differences were found (Figure 1). Blood pressure in nondiabetic patients was the best controlled risk factor although the percentage of patients with such control were lower in IM patients. Blood pressure control in diabetic patients was much lower, without differences between the four groups. IM patients had the lower control of resting heart rate and fasting glucose. Table 3 shows the prevalence of comorbidities and values of Charlson index; IM patients had the higher prevalence of comorbidities and median Charlson index.

All patients obtained improvements in guideline-recommended treatments after the inclusion visit, except patients attended by general practitioners who showed a significant reduction in antiplatelet treatments, beta-blockade agents, and statins (Table 4). It is remarkable that 260 (9.0%; 95% CI 8.9–9.1) patients did not received antiplatelet, beta-blockade agents, or statins and 296 (10.2%; 95% CI 10.1–10.3) only received one of these three treatments. OMT was prescribed in 25.9% (95% CI 25.6–26.2) of the patients and it was significantly more often prescribed by cardiologist

Table 1 Clinical characteristics and risk factors of patients according to medical speciality

	Total	Internal medicine	Hospital cardiologist	Outpatient cardiologist	General practitioners	*P*
Patients	2897	387 (13.4%)	591 (20.4%)	992 (34.2%)	927 (32.0%)	
Age (years)	67.4 (11.5)	70.5 (11.5)	66.4 (12.2)	67.0 (11.0)	67.3 (11.3)	<0.01*
Men (%)	71.5%	66.1%	72.9%	73.2%	71.2%	0.06
Years since onset of CHD	5.9 (6.0)	5.3 (5.8)	4.5 (6.1)	6.2 (6.1)	6.6 (5.7)	<0.01§
Percutaneous revascularization	41.2%	34.4%	58.4%	44.5%	29.8%	<0.01
Surgical revascularization	15.7%	10.3%	12.0%	22.6%	13.1%	<0.01
Hypertension	68.6%	74.9%	66.2%	67.4%	68.6%	0.02
Diabetes	38.8%	44.9%	40.5%	36.5%	37.7%	0.,02
Dyslipidemia	67.4%	60.0%	62.3%	72.1%	68.6%	<0.01
Active smoking	10.7%	11.8%	17.4%	10.0%	8.5%	<0.01
Obesity	29.0%	30.0%	23.0%	27.5%	34.1%	<0.01
Abdominal obesity	53.7%	54.0%	53.4%	51.1%	56.7%	0.16
Metabolic syndrome	50.2%	55.8%	60.6%	48.7%	44.1%	<0.01
Type of CHD						
Unstable angina	29.9%	21.7%	17.1%	35.1%	35.8%	<0.01
Myocardial infarction	42.3%	31.5%	45.9%	45.8%	40.8%	<0.01
Non-Q-wave infarction	41.2%	19.9%	25.4%	15.4%	15.3%	<0.01
Stable angina	34.5%	37.0%	43.0%	36.8%	34.5%	<0.01

CHD, coronary heart disease.

P-values for comparison between the four groups; except *internal medicine and the rest; §general practitioners and the rest.

Table 2 Results obtained from physical and biochemical examinations

	Total	Internal medicine	Hospital cardiologist	Outpatient clinic cardiologist	General practitioners	*P*
Systolic BP (mmHg)	132.7 (18.7)	138.1 (22.4)	130.6 (20.4)	132.9 (17.4)	131.4 (16.6)	<0.01*
Diastolic BP (mmHg)	75.2 (11.1)	75.4 (13.6)	73.6 (12.1)	75.8 (10.3)	75.6 (9.9)	<0.01**
Heart rate (bpm)	69.6 (12.6)	72.8 (14.6)	70.8 (14.6)	67.4 (11.4)	69.9 (11.1)	0.01*
BMI (kg/m^2)	28.4 (4.0)	28.5 (4.5)	28.0 (4.2)	28.4 (3.7)	28.7 (3.9)	0.04†
Abdominal waist (cm)	99.2 (11.5)	98.3 (12.1)	99.6 (12.0)	98.6 (11.8)	99.9 (11.2)	0.06
Glycemia (mg/dL)	120.5 (44.6)	130.8 (52.3)	125.1 (49.2)	119.9 (44.9)	113.9 (35.7)	<0.01§
Creatinine (mg/dL)	1.1 (0.5)	1.20 (0.8)	1.1 (0.6)	1,12 (0.5)	1.07 (0.4)	0.01§
GFR (mL/min per 1.73 m^2)	73.8 (25.6)	72.9 (29.5)	74.9 (27.2)	72.8 (23.5)	74.4 (24.8)	0.34
Total cholesterol (mg/dL)	187.2 (40.8)	179.0 (39.4)	186.5 (45.9)	187.4 (39.2)	190.8 (39.4)	0.03‡
LDL (mg/dL)	111.3 (34.9)	108.0 (35.2)	113.8 (40.4)	111.6 (33.6)	110.7 (32.5)	0.13
HDL (mg/dL)	47.1 (12.9)	45.2 (12.2)	42.7 (11.5)	46.3 (12.4)	51.2 (13.2)	<0.01§ 0.04†
Triglycerides (mg/dL)	130.0 (85.0–185.0)	120.0 (75.0–170.0)	135.0 (100.0–195.0)	130.0 (90.0–200.0)	122.5 (80.7–175.0)	0.26
TC/HDL	4.24 (1.9)	4.24 (1.4)	4.74 (3.5)	4.30 (1.3)	3.90 (1.1)	<0.01§ <0.01†

GFR, glomerular filtration rate; LDL, low-density lipoproteins; HDL, high-density lipoproteins; TC, total cholesterol.
Data presented as mean (SD), except triglycerides that is presented as median (interquartile range)
P-values for comparisons between the four groups; except *internal medicine and the rest; **hospital cardiologist and the rest; †hospital cardiologist compared to general practitioners; §internal medicine and the rest; ‡internal medicine and general practitioners.

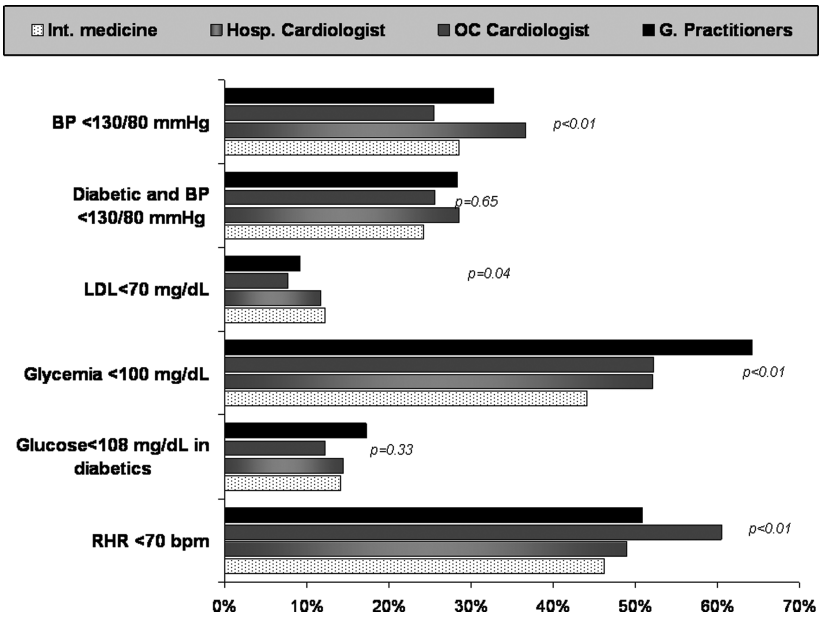

Figure 1 Risk factors control according to medical specialities (BP, blood pressure; G. Practitioners, general practitioners; Hosp. Cardiologist, hospital cardiologist; Int. Medicine, internal medicine; LDL, low-density lipoproteins; OC Cardiologist, outpatient clinic cardiologist; RHR, resting hear rate).

practitioners. Multivariate analysis, adjusted by age and gender, showed an independent association between OMT prescription and being attended by OCC (OR 1.44; 95% CI 1.14–1.82; $P = 0.003$) or HC (OR 1.73; 95% CI 1.33–2.24; $P < 0.001$). No association was found between OMT prescription and IM patients (OR 0.99; 95% CI 0.71–1.39; $P = 0.97$). Inclusion of Charlson index in the multivariate analysis did not alter the results; Charlson index ≥4 was associated to lower prescription of OMT (OR 0.77; 95% CI 0.61–0.98; $P = 0.03$).

Beta-blockade agents in patients with heart failure or COPD, blockade of renin–angiotensin–aldosterone system in patients with heart failure, and oral

Table 3 Comorbidities of patients according to the medical speciality where they were attended

	Total	Internal medicine	Hospital cardiologist	Outpatient clinic cardiologist	General practitioners	*P*
Heart failure	18.6%	26.5%	15.0%	15.7%	20.6%	<0.01
Atrial fibrillation	10.1%	17.1%	8.0%	7.4%	11.7%	<0.01
Stroke	9.9%	13.5%	10.0%	7.8%	10.5%	0.01
Peripheral artery disease	15.2%	18.2%	15.9%	15.0%	13.6%	0.2
Chronic obstructive pulmonary disease	15.9%	20.3%	16.1%	13.4%	16.6%	<0.01
GFR 30–60 (mL/min per 1.73 m^2)	25.1%	27.4%	25.2%	25.3%	23.9%	0.6
GFR <30 (mL/min per 1.73 m^2)	3.1%	5.8%	4.4%	3.0%	1.2%	0.01
Erectile dysfunction	16.2%	14.8%	12.7%	18.1%	16.8%	0.05
Charlson index	2.0 (1.0–4.0)	3.0 (1.0–5.0)	2.0 (1.0–4.0)	2.0 (1.0–4.0)	2.0 (1.0–3.0)	0.01*
0–1	38.6%	33.0%	38.1%	40.9%	38.7%	0.11
2–3	35.4%	33.7%	34.7%	34.2%	37.7%	0.4
≥4	26.0%	33.3%	27.2%	24.9%	23.6%	<0.01*

GFR, glomerular filtration rate.
P-values for the comparison between the four groups; except *internal medicine compared to the rest.

Table 4 Medical treatment of patients before and after the inclusion visit according to the speciality where they were attended

	Total	Internal medicine	Hospital cardiologist	Outpatient clinic cardiologist	General practitioners	*P* *P*
Antiplatelet before	80.7%	71.4%	70.8%	89.0%	82.1%	<0.01
Antiplatelet after	83.4%	85.8%	94.4%	87.9%	70.6%	<0.01
Beta-blockade before	58.2%	47.8%	50.9%	66.9%	57.7%	<0.01
Beta-blockade after	64.7%	62.8%	74.5%	70.7%	50.9%	<0.01
Statins before	68.3%	57.6%	58.5%	75.3%	71.6%	<0.01
Statins after	74.4%	74.7%	79.5%	81.3%	63.6%	<0.01
ACEI before	48.2%	47.3%	45.2%	47.8%	51.0%	0.20
ACEI after	55.5%	56.2%	58.1%	55.7%	52.8%	0.31
ARB before	20.5%	23.9%	15.3%	17.9%	25.6%	<0.01
ARB after	26.0%	29.1%	21.6%	21.2%	26.0%	0.01
Nitrates before	40.0%	37.7%	38.2%	41.3%	38.7%	0.10
Nitrates after	41.8%	53.5%	46.9%	43.6%	31.7%	<0.01
OMT before	27.0%	20.0%	23.2%	30.1%	29.1%	<0.01
OMT after	25.6%	22.0%	32.1%	27.0%	21.5%	<0.01

ACEI, angiotensin-converting enzyme inhibitors; ARB, angiotensin receptor blockers; OMT, optimal medical treatment.
P-values for comparisons between the four groups.

anticoagulation in patients with AF was statistically higher in patients attended by the cardiologist (Figure 2).

Discussion

The results of the TRECE registry demonstrate that CHD patients currently attended by different medical specialities are clinically similar although IM patients have higher prevalence of noncardiac comorbidities; control of risk factors is very low and even though prescription of OMT is scarce, it is more frequently carried out by the cardiologist, independently of such comorbidities. The sample of patients recruited by the TRECE registry is very much alike to previous reports [2,3,8,16,17,24,25] and reflects mainly the daily practice of CHD: males over 65 years with various risk factors and the antecedent of myocardial infarction 5 years before.

Regarding risk factors, the prevalence of obesity and smoking seems to be the most remarkable, in concordance to the results of the EUROASPIRE registry [25]. Obesity has been identified as an independent cardiovascular risk factor [26] and the physiologic basis of other risk factors such as hypertension, diabetes, low

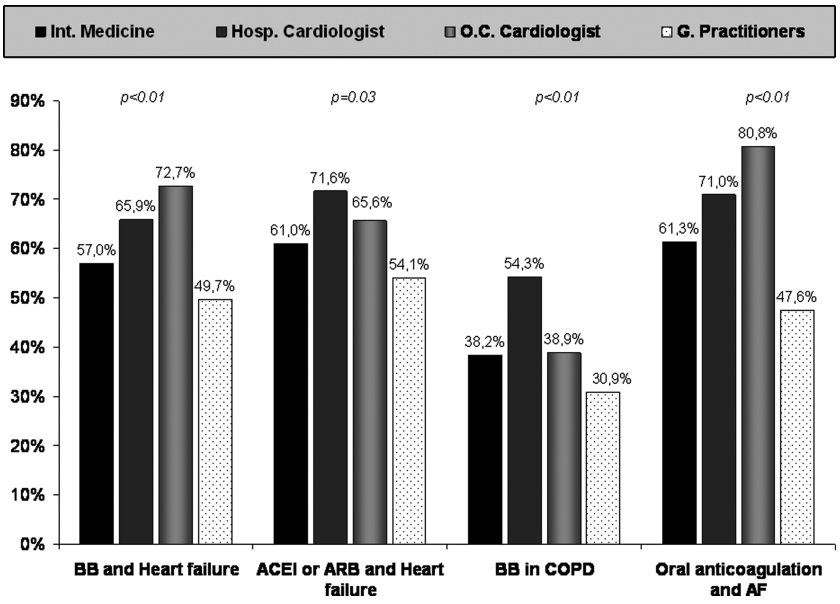

Figure 2 Prescription of guideline-recommended treatments in specific groups of patients (ACEI, angiotensin-converting enzyme inhibitors; AF, atrial fibrillation; ARB, angiotensin receptor blockers; BB, beta-blockade agents; COPD, chronic obstructive pulmonary disease; G .Practitioners, general practitioners; Hosp. Cardiologist, hospital cardiologist; Int. Medicine, internal medicine; OC Cardiologist, outpatient clinic cardiologist).

high-density lipoproteins (HDL) or the co-called metabolic syndrome [27]. In our sample of consecutive and nonselected patients with chronic CHD, more than half patients had abdominal obesity what could reflect the low conception of obesity as a risk factor. By other way, data showing 10.7% of active smokers are alarming. Large international registries [24,25] and trials on chronic CHD patients [11,28] agree in the fact that more than 10% of patients are current smokers. Despite being a low percentage of patients, the large impact on cardiovascular prognosis of smoking cessation on CHD patients makes it a first-line objective [10,29].

Despite the well-proven evidence that OMT improves the prognosis of CHD patients [8,9,11], its prescription is still low [5,8,24]. The explanation for such discouraging data can be due to many reasons such as poor experience in drugs management [2], low knowledge of guidelines recommendations [16,17], government health policies, or time limitations [3]. Our results show that cardiology patients received more frequently guideline-recommended treatments, as ACEI or ARB in heart failure patients or oral anticoagulation in patient with AF. Even more, prescription of beta-blockade agents in patients with COPD was higher if patients were attended by the cardiologist. These data reflect daily practice and may support initiatives to improve medical treatment and risk-factor control by all medical practitioners currently involved in CHD management.

IM patients had a slightly higher mean age and higher prevalence of comorbidities. Previous data from Medicare patients showed that attention by cardiologist, compared to other specialities, during an acute coronary syndrome was associated to higher prescription of aspirin and thrombolytic agents, and significantly lower 1-year mortality rate [12]. More recently, the CRUSADE registry demonstrated that patients attended by cardiologist received more frequently guideline-recommended medical treatments and coronary revascularization procedures in the setting of acute coronary syndromes and had lower mortality [1]. In addition, data from a large Canadian registry have shown that attention by cardiologist was independently associated to higher rate of filling discharge prescriptions [30]. The presence of noncardiac pathologies has been argued to explain differences in medical treatments of CHD patients. Noncardiac comorbidities impair significantly the prognosis of CHD patients, and their assessment by the Charlson index can easily identify a subset of high-risk patients [15]. Noncardiac comorbidities were the most relevant differences between patients of our simple, and the high-comorbidity category was identified as an independent predictor of lower OMT prescription; nevertheless, comorbidities did not explain the lower prescription of OMT carried out by noncardiologist practitioners.

The main limitation of the TRECE registry seems to be that patients were not included from other medical specialities that also attend CHD patients, such as neurology, endocrinology, or vascular surgery specialist. The investigators committee designed the registry in order to describe the clinical reality of CHD patients so decided to include patients in whom the influence of CHD diagnosis was maximum. OMT was assessed according to

the sum of the four medications included in guidelines recommendations [10] and this has several limitations to reflect the best treatment because it does include the optimal doses of each drug, interactions, contraindications, or considerations of special population; nevertheless, this method has been widely used previously [2,3,8,9] and, at least, reflects prescription of guideline-recommended treatments. Our results showed that noncardiac comorbidity is highly prevalent and determinates medical management and this probably reflects that the sample is not extremely selected. For being a multicenter study, a central laboratory was not used and this can cause alterations in lipid determinations.

So in conclusion, risk-factor control and prescription of OMT to CHD patients are low; current CHD patients are older and have more comorbidities and received less frequently OMT compared to patients attended by cardiologist, but these clinical features do not explain prescription differences. Encouraging permanent training programs and creation of multidisciplinary teams for cardiovascular patients' management seem necessary strategies to improve current status of CHD patients care.

Acknowledgments

The TRECE registry has an unrestricted grant of Servier Laboratories, Spain.

Conflict of Interest

The authors declare no conflict of interest.

References

1. Roe MT, Chen AY, Mehta RH, et al. Influence of inpatient service specialty on care processes and outcomes for patients with non ST-segment elevation acute coronary syndromes. *Circulation* 2007;**116**:1153–1161.
2. Dewilde S, Carey IM, Richards N, Whincup PH, Cook DG. Trends in secondary prevention of ischaemic heart disease in the UK 1994 2005: Use of individual and combination treatment. *Heart* 2008;**94**:83–88.
3. Graham IM, Stewart M, Hertog MG. Factors impeding the implementation of cardiovascular prevention guidelines: Findings from a survey conducted by the European Society of Cardiology. *Eur J Cardiovasc Prev Rehabil* 2006;**13**:839–845.
4. Heras M, Marrugat J, Aros F, et al. Reduction in Acute myocardial infarction mortality over a five-year period. *Rev Esp Cardiol* 2006;**59**:200–208.
5. Cubbon RM, Wheatcroft SB, Grant PJ, et al. Temporal trends in mortality of patients with diabetes mellitus suffering acute myocardial infarction: A comparison of over 3000 patients between 1995 and 2003. *Eur Heart J* 2007;**28**:540–545.
6. Rosamond W, Flegal K, Furie K, et al. Heart disease and stroke statistics—2008 update: A report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation* 2008;**117**:e25–146.
7. Davies AR, Smeeth L, Grundy EM. Contribution of changes in incidence and mortality to trends in the prevalence of coronary heart disease in the UK: 1996 2005. *Eur Heart J* 2007;**28**:2142–2147.
8. Daly C, Clemens F, Lopez-Sendon JL, et al. The impact of guideline compliant medical therapy on clinical outcome in patients with stable angina: Findings from the Euro Heart Survey of stable angina. *Eur Heart J* 2006;**27**:1298–1304.
9. Rogers AM, Ramanath VS, Grzybowski M, et al. The association between guideline-based treatment instructions at the point of discharge and lower 1-year mortality in Medicare patients after acute myocardial infarction: The American College of Cardiology's Guidelines Applied in Practice (GAP) initiative in Michigan. *Am Heart J* 2007;**154**:461–469.
10. Fraker TD Jr, Fihn SD, Gibbons RJ, et al. 2007 Chronic Angina Focused Updated of the ACC/AHA 2002 Guidelines for the Management of Patients With Chronic Stable Angina: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines Writing Group to Develop the Focused Update of the 2002 Guidelines for the Management of Patients With Chronic Stable Angina. *Circulation* 2007;**116**:2762–2772.
11. Boden WE, O'Rourke RA, Teo KK, et al. Optimal medical therapy with or without PCI for stable coronary disease. *N Engl J Med* 2007;**356**:1503–1516.
12. Frances CD, Go AS, Dauterman KW, et al. Outcome following acute myocardial infarction: Are differences among physician specialties the result of quality of care or case mix? *Arch Intern Med* 1999;**159**:1429–1436.
13. Garcia-Castelo A, Muniz J, Sesma Sanchez P, Castro-Beiras A. Use of diagnostic and therapeutic resources in patients hospitalized for heart failure: Influence of admission ward type (INCARGAL Study). *Rev Esp Cardiol* 2003;**56**:49–56.
14. Chen J, Radford MJ, Wang Y, Marciniak TA, Krumholz HM. Effectiveness of beta-blocker therapy after acute myocardial infarction in elderly patients with chronic obstructive pulmonary disease or asthma. *J Am Coll Cardiol* 2001;**37**:1950–1956.
15. Sachdev M, Sun JL, Tsiatis AA, Nelson CL, Mark DB, Jollis JG. The prognostic importance of comorbidity for mortality in patients with stable coronary artery disease. *J Am Coll Cardiol* 2004;**43**:576–582.
16. Gonzalez-Juanatey JR, Alegria E, Aznar J, Bertomeu-Martinez V, Franch-Nadal J, Palma-Gamiz JL.

Knowledge and implementation of cardiovascular risk clinical practice guidelines by general practitioners and specialists. *Rev Esp Cardiol* 2006;**59**:801–806.
17. Heidrich J, Behrens T, Raspe F, Keil U. Knowledge and perception of guidelines and secondary prevention of coronary heart disease among general practitioners and internists. Results from a physician survey in Germany. *Eur J Cardiovasc Prev Rehabil* 2005;**12**:521–529.
18. Mancia G, De BG, Dominiczak A, et al. 2007 Guidelines for the management of arterial hypertension: The Task Force for the Management of Arterial Hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC). *Eur Heart J* 2007;**28**:1462–1536.
19. Diaz A, Bourassa MG, Guertin MC, Tardif JC. Long-term prognostic value of resting heart rate in patients with suspected or proven coronary artery disease. *Eur Heart J* 2005;**26**:967–974.
20. Ryden L, Standl E, Bartnik M, et al. Guidelines on diabetes, pre-diabetes, and cardiovascular diseases: Executive summary. The Task Force on Diabetes and Cardiovascular Diseases of the European Society of Cardiology (ESC) and of the European Association for the Study of Diabetes (EASD). *Eur Heart J* 2007;**28**:88–136.
21. Expert Panel on Detection, Evaluation, And Treatment of High Blood Cholesterol In Adults (Adult Treatment Panel III). Executive Summary of The Third Report of The National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, And Treatment of High Blood Cholesterol In Adults (Adult Treatment Panel III). *JAMA* 2001;**285**:2486–2497.
22. National Kidney Foundation. K/DOQI clinical practice guidelines for chronic kidney disease: Evaluation, classification, and stratification. *Am J Kidney Dis* 2002;**39**:1–266.
23. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: Development and validation. *J Chronic Dis* 1987;**40**:373–383.
24. Bhatt DL, Steg PG, Ohman EM, et al. International prevalence, recognition, and treatment of cardiovascular risk factors in outpatients with atherothrombosis. *JAMA* 2006;**295**:180–189.
25. EUROASPIRE I and II Group. European Action on Secondary Prevention by Intervention to Reduce Events. Clinical reality of coronary prevention guidelines: A comparison of EUROASPIRE I and II in nine countries. *Lancet* 2001;**357**:995–1001.
26. Yusuf S, Hawken S, Ounpuu S, et al. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): Case-control study. *Lancet* 2004;**364**:937–952.
27. Hossain P, Kawar B, El NM. Obesity and diabetes in the developing world—a growing challenge. *N Engl J Med* 2007;**356**:213–215.
28. Barter P, Gotto AM, LaRosa JC, et al. HDL cholesterol, very low levels of LDL cholesterol, and cardiovascular events. *N Engl J Med* 2007;**357**:1301–1310.
29. Wilson K, Gibson N, Willan A, Cook D. Effect of smoking cessation on mortality after myocardial infarction: Meta-analysis of cohort studies. *Arch Intern Med* 2000;**160**:939–944.
30. Jackevicius CA, Li P, Tu JV. Prevalence, predictors, and outcomes of primary nonadherence after acute myocardial infarction. *Circulation* 2008;**117**:1028–1036.