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Treatment decisions in stable coronary artery disease: Insights from the Euro Heart Survey on Coronary Revascularization

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Objective: We sought to assess determinants of clinical decision making in patients with stable coronary artery disease.

Methods: The 2936 patients with stable angina pectoris who enrolled in the Euro Heart Survey on Coronary Revascularization were the subject of this analysis. After the diagnosis has been confirmed, physicians decided on treatment: medical management or revascularization therapy by means of percutaneous coronary intervention or coronary bypass surgery. We applied logistic regression analyses to evaluate the relation between baseline characteristics and treatment decision: medical treatment versus percutaneous coronary intervention, medical treatment versus coronary bypass surgery, and percutaneous coronary intervention versus coronary bypass surgery.

Results: The median age was 64 years, 77% were men, and 20% had diabetes. Medical therapy was intended in 690 (24%) patients, percutaneous coronary intervention in 1503 (51%) patients, and coronary bypass surgery in the remaining 743 (25%) patients, respectively. Revascularization was generally preferred in patients with more severe anginal complaints, an intermediate-to-large area of myocardium at risk, and preserved left ventricular function who had not undergone prior coronary revascularization, provided lesions were suitable for treatment. Coronary bypass surgery was preferred over percutaneous coronary intervention in multivessel or left main disease, as well as in those with concomitant valvular heart disease, provided a sufficient number of lesions were suitable for coronary bypass surgery. In those with previous coronary bypass surgeries, more often percutaneous coronary intervention was preferred than redo coronary bypass surgery. Diabetes was not associated with more frequent preference for coronary bypass surgery.

Conclusions: In the hospitals that participated in the Euro Heart Survey on Coronary Revascularization, treatment decisions in stable coronary artery disease were largely in agreement with professional guidelines and determined by multiple factors. Most important deviations between guideline recommendations and clinical practice were seen in patients with extensive coronary disease, impaired left ventricular function, and diabetes.

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In the Western world stable coronary disease is a common and disabling disorder. Treatment aims to minimize or abolish symptoms, to prevent disease progression, and to improve prognosis by reducing the risk of myocardial infarction or death. According to current treatment guidelines, patients should receive cardioprotective pharmacotherapy, including antiplatelet, antithrombotic, and lipid-lowering agents, as well as antianginal medication. In selected patients coronary revascularization by means of either percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG) might be appropriate. In the absence of symptomatic indication, revascularization is recommended in patients with left main disease, multivessel disease, significant disease of the proximal part of the left anterior descending artery (LAD), and a fair amount of viable myocardium at risk. CABG is preferred in patients with diabetes, those with more extensive disease, those with impaired left ventricular function, and those with anatomy that is not suitable for PCI.[1-11]

The European Society of Cardiology realized that the clinical management of cardiac patients in daily practice might vary from treatment guidelines. A broad range of clinical and lesion-specific characteristics might play a role in shaping treatment decisions in the real world. To obtain quantitative information on the adherence to European and international guidelines across member states, the European Society of Cardiology has launched the Euro Heart Survey (EHS) program (extensive information regarding this program is available on the Web).[12] The EHS on Coronary Revascularization (EHS-CR), which was conducted in 2001-2002, with follow-up in 2003, enrolled 3006 consecutive patients (in 130 participating centers) with documented stable coronary disease undergoing coronary angiography. This well-characterized study population provides a unique opportunity to conduct a systematic analysis of the relation between patient characteristics and choices about patient management.

Abbreviations and Acronyms

CABG = coronary artery bypass grafting
EHS = Euro Heart Survey
EHS-CR = Euro Heart Survey on Coronary Revascularization
LAD = left anterior descending artery
PCI = percutaneous coronary intervention

Materials and Methods

Patients

The EHS-CR has been described in detail elsewhere.[12,13] Briefly, the survey was designed to screen all consecutive patients undergoing invasive coronary diagnostic or therapeutic procedures. Patients were enrolled if they had a stenosis diameter of at least 50% in at least one major epicardial coronary artery. Data were then sent to a central database in the European Heart House (Sophia Antipolis, France) through the Web by using the Macro software (InferMed). The collected data included demographics, comorbidity, diagnosis, and detailed information regarding diagnostic angiography and treatment modalities. Clinical outcome and complications were recorded during the initial hospitalization and at 1-year follow-up. By using the applied software, data were automatically checked for completeness, internal consistency, and accuracy. The data management staff at the European Heart House performed additional edit checks. If necessary, queries were resolved with the local data-collecting officers. Between November 1, 2001, and March 1, 2002, a total of 5767 patients were enrolled. Follow-up was obtained at 11 months after enrollment. The current analysis is limited to the 3006 (52%) patients with stable angina as the primary diagnosis.

Treatment Decisions

The EHS-CR is a descriptive study, and the survey protocol did not dictate any treatment decision. In general physicians were encouraged to treat their patients in conformance with the most recent guidelines. To be informed of the physician's preferred and intended treatment, the survey included the following question: As the treating physician, which treatment option would be your first choice? According to the reply to this question, patients were classified with a physician's intention for medical treatment, PCI, or CABG.

Data Description and Data Analysis

Continuous data are described as median values with corresponding 25th and 75th percentiles, and dichotomous data are described as counts and percentages. Differences in baseline clinical and angiographic characteristics in subgroups of patients according to intended treatment were analyzed by using unpaired Student *t* tests, analyses of variance (continuous data), and χ^2 tests (dichotomous data) as appropriate. All statistical tests were 2 sided.

Altogether, 893 (30%) patients had missing data on at least one of the variables that were considered as potential determinants of treatment decisions (Table 1). Simple missing data imputation was therefore applied by assigning the series mean value of the variable at hand. Univariable and multivariable logistic regression analyses were then applied to further evaluate the relation between a broad range of baseline characteristics and intended treatment. Separate regression models were developed for intended medical treatment versus PCI, medical treatment versus CABG, and CABG versus PCI. All variables entered the multivariable stage, irrespective of the results of univariable analyses. The final multivariable model was then constructed by means of backward deletion of the least significant characteristics, while applying a *P* value of .05 as the threshold of significance.

The performance of the multivariable models was studied with respect to discrimination and calibration. *Discrimination* refers to the ability to distinguish patient subgroups (intended medical treatment vs PCI, intended medical treatment vs CABG, and intended CABG vs PCI) by using the model. It was quantified by

Table 1. Clinical characteristics of the study population

	All	Intended treatment			*P* value
		Medical	PCI	CABG	
No. of patients	2936	690	1503	743	
Demographics					
Age, y	64 (56-71)	64 (56-71)	63 (54-70)	66 (57-72)	*
Male sex	77	75	76	80	†
Risk factors, medical history, and medication at admission					
Current smoking	21	17	23	21	†
Diabetes mellitus (patients using insulin or oral antidiabetic drugs)	20	22	19	21	
Hypercholesterolemia	69	67	71	66	†
Hypertension	61	64	60	61	
PCI	24	27	28	12	*
CABG	13	24	12	4	*
Myocardial infarction	43	49	41	40	‡
Peripheral vascular disease	13	13	11	17	*
Cerebrovascular disease	8	8	6	10	†
Renal insufficiency	3	5	4	2	†
Use of β-blockers, calcium antagonists, or nitrates					‡
None	11	13	10	11	
Mono	36	40	37	32	
Double	41	37	42	45	
Triple	11	10	12	12	
Presentation					
Concomitant valvular heart disease	7	8	4	13	*
NYHA symptomatic (heart failure) class					*
No heart failure	84	80	89	80	
I or II	10	13	8	13	
III or IV	5	8	3	7	
CCS angina class					*
I	15	24	14	10	
II	48	49	50	42	
III	32	25	31	41	
IV	5	2	5	6	
Size of the myocardium at risk§					*
Small	28	39	29	15	
Intermediate	53	44	54	58	
Large	19	16	17	27	
EuroSCORE‖	3 (2-5)	4 (2-6)	3 (1-5)	4 (2-6)	*
Left ventricular function¶					*
Normal (LVEF >50%)	66	59	71	62	
Mild impairment (LVEF 40%-50%)	23	23	22	26	
Moderate impairment (LVEF 30%-40%)	7	10	5	9	
Severe impairment (LVEF <30%)	4	8	2	3	

Continuous data (age and EuroSCORE) are presented as median values (25th-75th percentiles), and dichotomous data are presented as percentages. *PCI*, Percutaneous coronary intervention; *CABG*, coronary artery bypass grafting; *NYHA*, New York Heart Association; *CCS*, Canadian Cardiovascular Society; *LVEF*, left ventricular ejection fraction. *P* values: *<.001, †<.05, ‡<.01. §Qualitative estimate based on noninvasive diagnostics, as described in the American College of Cardiology/America Heart Association guidelines.[18] ‖European System for Cardiac Operative Risk Evaluation, which is a score developed to quantify the risk of perioperative mortality in patients scheduled for cardiac surgery. ¶Based on quantitative or qualitative measurements.

using a measure of concordance, the c-statistic. For binary outcomes, the c-statistic is identical to the area under the receiver operating characteristic curve. The c-statistic lies between 0.5 and 1 and is better if closer to 1. *Calibration* refers to whether the predicted frequencies (by using the model) of patients with a physician's preference for a specific treatment modality agree with the observed frequencies. Calibration was measured with the Hosmer-Lemeshow goodness-of-fit test.[14,15]

Results

Patients and Intended Treatment

The intended treatment was not recorded in 70 (2.3%) patients, leaving 2936 patients suitable for analysis. Medical therapy was intended in 690 (24%) patients, PCI in 1503 (51%) patients, and CABG in the remaining 743 (25%) patients, respectively. Eighty-six percent of patients who were selected for coronary revascularization underwent this procedure within 1 year after initial coronary angiography. Twelve percent of patients undergoing PCI were treated for in-stent restenosis or restenosis after a prior nonstent procedure. Stents were used in 74% of patients undergoing PCI. In 15% of patients undergoing CABG, coronary surgery was combined with valve repair or replacement.

Clinical and Angiographic Characteristics

The median age of the study population was 64 years, and 77% were men. Twenty percent of patients had diabetes. A history of prior PCI was reported in 24% of patients, and prior CABG was reported in 13%. Most patients had mild-to-moderate anginal complaints and an intermediate risk profile. A moderately or severely impaired left ventricular function (left ventricular ejection fraction <40%) was observed in 11%. Thirty-four percent of patients had single-vessel disease, 57% had multivessel disease, and 9% had left main disease.

Important differences in relevant clinical (Table 1) and angiographic (Table 2) baseline characteristics were observed according to intended treatment. Patients in whom the physician preferred medical therapy more often had a history of coronary revascularization or a history of myocardial infarction than the remaining patients. Their anginal complaints were relatively mild, but they more often had symptomatic heart failure. Patients scheduled for medical therapy had a small area of jeopardized myocardium, a high number of total occlusions and type C lesions, and a low number of lesions suitable for revascularization.

Patients scheduled for PCI were younger and less often had congestive heart failure than the remaining patients. Their anginal complaints were usually moderate, whereas only a limited number of diseased segments was observed. The number of total occlusions and type C lesions was low. Compared with patients scheduled for medical treatment, patients scheduled for PCI less often had a history of CABG or myocardial infarction. Compared with patients scheduled for CABG, they more often had a history of CABG but less often had proximal LAD or left main disease.

Patients in whom the physician preferred CABG were older, were more often men, and more often had peripheral vascular disease, cerebrovascular disease, and valvular heart disease than the remaining patients. They often had severe anginal symptoms, a large area of myocardium at risk, and extensive vessel disease. The number of lesions suitable for PCI was low.

Determinants of Intended Revascularization Versus Medical Treatment

The number of lesions suitable for PCI was the most important determinant of intended PCI versus medical treatment: a PCI was 28 times more likely in patients with at least one lesion suitable for such an approach (Table 3). The severity of the anginal symptoms, the amount of jeopardized myocardium, and left ventricular function were also important determinants of the choice for PCI versus medical treatment. Patients in Canadian Cardiovascular Society anginal class II to IV were 1.8 to 6.2 times more likely to undergo PCI than those in class I. Patients with an intermediate-to-large amount of myocardium at risk were 2.0 to 2.4 times more likely to undergo PCI than those with a small amount. In contrast, patients with moderately to severely impaired left ventricular function were 2.6 to 3.7 times less likely to be scheduled for PCI (odds ratio, 0.38-0.27).

The number of lesions suitable for CABG was the most important determinant of intended CABG versus medical treatment: a CABG was 5.1 to 36 times more likely in patients with 1 to 3 or more lesions suitable for the surgical approach (Table 3). The severity of the anginal symptoms, the amount of jeopardized myocardium, and left ventricular function were also important determinants of the choice for CABG versus medical treatment. However, whether a CABG has been performed in the past was a more decisive factor: patients with a history of CABG were 25 to 50 times more likely to be scheduled for CABG.

Determinants of Intended CABG Versus PCI

In patients selected for PCI or CABG, the number of lesions suitable for the other technique was the most dominating factor for the final treatment choice (Table 3). A history of CABG, the presence of left main disease, and the presence of valvular heart disease were also important determinants of the physician's preference for either CABG or PCI. Diabetes and left ventricular function were not associated with the physician's choice in this respect.

Performance of Predictive Models

The discriminative power of the model to separate patients with a physician's preference for medical versus revascularization treatment was good. The c-statistics for the PCI versus medical treatment and CABG versus medical treatment models were 0.85 and 0.92, respectively. The Hosmer-Lemeshow tests for calibration were nonsignificant ($P = .33$ and $P = .29$, respectively; Figure 1, *left and middle panels*), indicating that the models accurately predicted the probability for a patient to be selected for coronary revascularization (PCI or CABG). The discriminative power of the model to separate patients with a physician's preference for

Table 2. Angiographic characteristics of the study population

	All	Intended treatment			*P* value
		Medical	PCI	CABG	
No. of patients	2936	690	1503	743	
Mitral insufficiency potentially requiring surgical intervention	14	16	11	17	*
Diseased arteries					
Left anterior descending	73	69	67	88	*
Proximal left anterior descending	33	26	26	52	*
Left circumflex	59	58	51	78	*
Right coronary	64	64	56	80	*
Left main	9	8	4	21	*
No. of diseased arteries					*
1	34	40	44	8	
2	30	26	35	21	
3	27	25	17	50	
LM	9	8	4	21	
No. of diseased segments					*
1	29	34	38	8	
2	23	21	28	15	
3	18	17	16	21	
≥4	30	28	18	57	
Total occlusions					*
0	59	46	69	51	
1	26	31	21	31	
2	9	13	6	12	
≥3	6	11	4	6	
Type C lesions					*
0	56	48	63	48	
1	23	24	23	22	
2	11	14	8	15	
≥3	11	14	7	14	
Lesions suitable for PCI					*
0	28	56	6	46	
1	37	22	53	16	
2	20	12	26	15	
≥3	16	10	15	23	
Lesions suitable for CABG					*
0	24	41	26	4	
1	26	21	37	8	
2	17	13	20	16	
≥3	33	24	17	72	
Grafts with >50% diameter stenosis†					*
0	39	50	30	27	
1	30	28	34	27	
≥2	31	22	36	46	

Data represent percentages. *PCI*, Percutaneous coronary intervention; *CABG*, coronary artery bypass grafting. *P* values: *<.001. †In patients with a history of prior CABG only.

CABG versus PCI treatment was also excellent (c-statistic = 0.95). The Hosmer-Lemeshow test for calibration was significant ($P < .001$), but the difference between the expected and observed probabilities was less than 3% in 8 patient subgroups on the basis of the deciles of the probability distribution (Figure 1, *right panel*).

Discussion

In this analysis of patients with stable angina and angiographically significant coronary artery disease who enrolled in the EHS-CR study, revascularization was generally preferred in patients with more severe anginal complaints, an intermediate-to-large area of myocardium at risk, and a

Table 3. Association between patient characteristics and the physician's preference for PCI versus medical treatment, CABG versus medical treatment, and CABG versus PCI

	Intended treatment					
	PCI vs medical		CABG vs medical		CABG vs PCI	
C-statistic	0.85		0.92		0.95	
	Odds ratio (95% CI)*	χ^2	Odds ratio (95% CI)†	χ^2	Odds ratio (95% CI)‡	χ^2
Age, y						
<60			1			
60-70			0.62 (0.41-0.94)	5		
≥70			0.42 (0.25-0.69)	12		
Male sex	1.4 (1.1-1.8)	5	1.6 (1.1-2.3)	6		
Hypercholesterolemia					0.62 (0.45-0.85)	9
Prior PCI			0.65 (0.43-0.99)	4	0.63 (0.43-0.93)	5
Prior CABG						
No	1		1		1	
Yes, no diseased grafts	0.43 (0.27-0.70)	11	0.02 (0.01-0.05)	66	0.07 (0.02-0.22)	21
Yes, ≥1 diseased graft	1.5 (1.0-2.4)	3	0.04 (0.02-0.07)	86	0.02 (0.01-0.04)	88
Prior myocardial infarction			0.75 (0.54-1.0)	3		
Renal insufficiency			0.28 (0.12-0.66)	9	0.21 (0.08-0.53)	11
Concomitant valvular heart disease			4.8 (2.7-8.4)	30	5.9 (3.7-9.9)	44
NYHA symptomatic (heart failure) class						
No heart failure			1			
I or II			1.0 (0.62-1.6)	0		
III or IV			0.46 (0.25-0.84)	6		
CCS angina class						
I	1		1			
II	1.8 (1.3-2.5)	13	1.6 (1.0-2.6)	4		
III	1.8 (1.3-2.6)	11	2.4 (1.4-3.9)	11		
IV	6.2 (2.7-14)	19	7.1 (2.5-20)	13		
Noninvasive risk stratification						
Low	1		1			
Intermediate	2.0 (1.6-2.7)	27	3.3 (2.2-4.9)	35		
High	2.4 (1.6-3.6)	18	3.4 (2.0-5.7)	20		
EuroSCORE ≥3	0.71 (0.54-0.93)	6	2.1 (1.3-3.4)	10	2.0 (1.5-2.7)	19
Left ventricular function						
Normal (LVEF >50%)	1		1			
Mild impairment (LVEF 40%-50%)	1.0 (0.79-1.3)	0	0.75 (0.52-1.1)	3		
Moderate impairment (LVEF 30%-40%)	0.38 (0.24-0.61)	16	0.49 (0.27-0.87)	6		
Severe impairment (LVEF <30%)	0.27 (0.14-0.52)	15	0.18 (0.08-0.42)	16		
Proximal left anterior descending disease			2.2 (1.6-3.1)	22	1.9 (1.4-2.6)	17
Left main disease			6.6 (3.4-12)	34	12 (6.3-22)	60
No. of diseased arteries						
1			1		1	
2			2.1 (1.2-3.5)	8	1.4 (0.85-2.2)	2
3			3.9 (2.2-6.8)	23	5.4 (3.2-8.9)	43
Total occlusions						
0	1				1	
1	0.69 (0.52-0.91)	7			1.3 (0.93-1.8)	2
2	0.56 (0.36-0.87)	7			1.1 (0.67-1.9)	0
≥3	1.0 (0.60-1.8)	0			0.42 (0.21-0.87)	6
Type C lesions						
0			1			
1			0.87 (0.59-1.3)	0		
2			0.73 (0.45-1.2)	2		
≥3			0.40 (0.24-0.66)	12		

Table 3. Continued

	Intended treatment					
	PCI vs medical		CABG vs medical		CABG vs PCI	
	Odds ratio (95% CI)*	χ^2	Odds ratio (95% CI)†	χ^2	Odds ratio (95% CI)‡	χ^2
Lesions suitable for PCI						
0	1		1		1	
1	28 (20-41)	308	0.55 (0.36-0.85)	7	0.03 (0.02-0.05)	150
2	35 (22-56)	232	0.46 (0.28-0.75)	10	0.01 (0.01-0.02)	185
≥3	41 (24-69)	189	0.40 (0.24-0.66)	13	0.01 (0.01-0.02)	185
Lesions suitable for CABG						
0	1		1		1	
1	0.74 (0.51-1.1)	3	5.1 (2.8-9.4)	27	4.7 (2.3-9.4)	19
2	0.52 (0.33-0.80)	9	13 (6.9-23)	67	27 (13-56)	77
≥3	0.26 (0.17-0.41)	34	36 (20-66)	136	113 (53-239)	152

Odds ratios are adjusted for all variables that remained significant in multivariable analysis. χ^2 represents the contribution of the variable at hand in the final multivariable model. *PCI*, Percutaneous coronary intervention; *CABG*, coronary artery bypass grafting; *NYHA*, New York Heart Association; *CCS*, Canadian Cardiovascular Society; *LVEF*, left ventricular ejection fraction. *Odds ratio >1: increased preference for PCI rather than medical treatment. †Odds ratio >1: increased preference for CABG rather than medical treatment. ‡Odds ratio >1: increased preference for CABG rather than PCI.

preserved left ventricular function who had not undergone prior coronary revascularization, provided lesions were suitable for treatment. Coronary surgery was preferred over PCI in patients with multivessel or left main disease, as well as in those with concomitant valvular heart disease, provided a sufficient number of lesions were suitable for CABG. These choices are coherent with the 1999 and 2002 guidelines to a large extent. There were, however, some intriguing variations between the guidelines and the routine practice that is reflected in this survey. Impaired left ventricular function was associated with an increased preference for medical treatment. This contrasts with guidelines that recommend coronary revascularization for most patients with multivessel disease, especially those with abnormal left ventricular

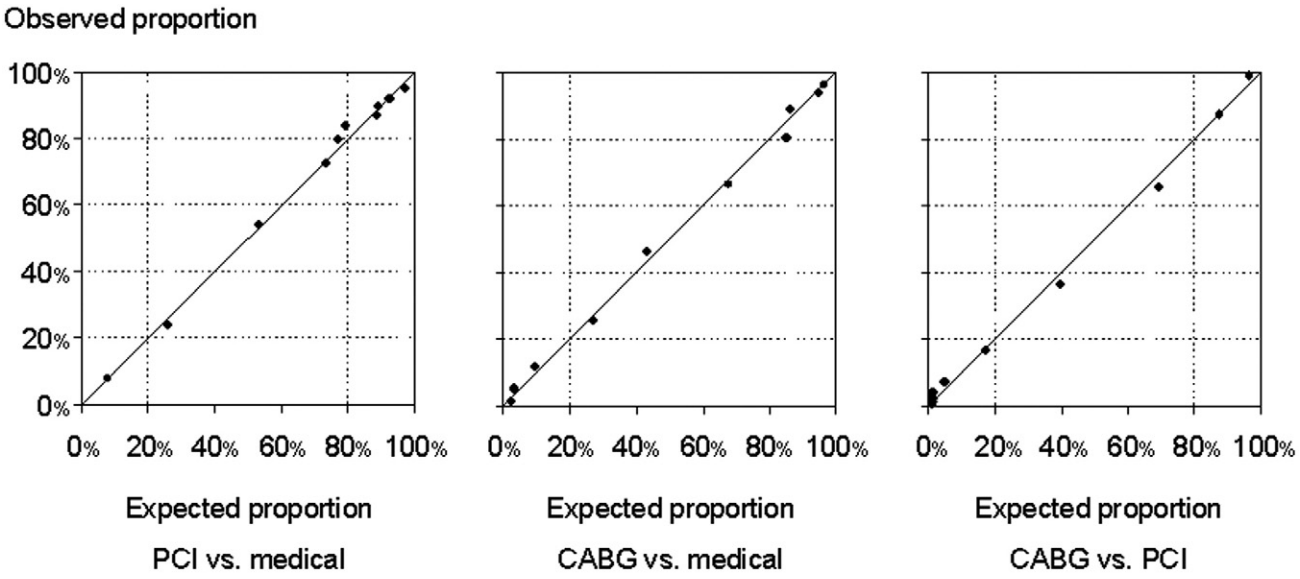

Figure 1. Expected versus observed proportions of patients with a physician's preference for specific treatment within deciles of expected proportions, which are based on multivariable logistic regression models. *Left,* Expected proportion of patients with a physician's preference for percutaneous coronary intervention *(PCI)* rather than medical treatment. *Middle,* Expected proportion of patients with a physician's preference for coronary artery bypass grafting *(CABG)* rather than medical treatment. *Right,* Expected proportion of patients with a physician's preference for CABG rather than PCI.

Table 4. Reasons for choosing medical treatment only

Reason (not exclusive)	Percentage of patients
General condition of the patient not suitable for PCI	13
General condition of the patient not suitable for CABG	13
Low-risk natural history	45
Very high-risk procedure	16
Cardiac contraindication	6
Vessels not suitable for PCI or CABG	49
Patient refused PCI	4
Patient refused CABG	9

PCI, Percutaneous coronary intervention; *CABG*, coronary artery bypass grafting.

function.[4] Indeed, randomized trials comparing CABG with medical treatment in multivessel disease demonstrated a significant improvement in symptoms, as well as a significant mortality reduction during long-term follow-up in favor of revascularization treatment, regardless of left ventricular function.[11] There are only a few randomized trials comparing PCI versus medical treatment, but guidelines speculate that patients with an intermediate-to-large myocardium at risk (such as those with 2-vessel disease and a proximal LAD lesion) will profit as much from percutaneous transluminal coronary angioplasty as CABG. The rationale behind the deviation from the guidelines that we observed is not entirely clear. In fact, the interpretation of our data might be hampered by the heterogeneous nature of the medically treated patients. In 45% of patients selected for medical treatment, physicians reported a low-risk natural history as their main motivation behind their choice (Table 4). On the other hand, in 16% of patients, medical treatment was chosen because of a suspected high risk of perioperative complications.

Patients with a prior history of CABG were much more often selected for medical treatment, independent of the severity of anginal symptoms, the extent of coronary disease, and the number of lesions suitable for PCI or CABG. Clinical trials comparing redo CABG versus medical treatment in stable angina are lacking, as are trials comparing redo CABG with PCI. The fact that physicians have been educated with the principle "primum non nocere" ("first do no harm," "better safe than sorry") might therefore partly explain our findings.

It is interesting that diabetes was not associated with more frequent preference for CABG. Because large-scale randomized trials are lacking, it is still unclear whether optimal medical management or revascularization should be preferred in the general population of patients with stable angina and diabetes. The ongoing Bypass Angioplasty Revascularization Investigation 2 Diabetes trial, in which diabetic patients will be randomly allocated to aggressive medical management, targeting at optimal glycemic and metabolic control, or revascularization, might help to solve this "burgeoning dilemma," as the investigators call it.[16]

Limitations

Our study has several limitations that should be acknowledged. First, the EHS surveys were conducted mainly in hospital settings with liberal access to coronary revascularization facilities. It is known that the availability of specific medical resources, including coronary revascularization, decreases the threshold for its use.[17]

Second, our sample only represents a small fraction of all patients admitted to catheterization laboratories throughout Europe during the study period, and one might question its representativeness for the entire population. It is well known that decision processes might vary regionally, as well as between hospitals within a geographic region. Unfortunately, we were not able to study these phenomena because of the fact that there were too few participating hospitals within meaningful regions and too few patients per hospital (the average number of patients per hospital was 23).

Third, patients were only enrolled in the EHS-CR once the presence of coronary disease had been established by means of angiography. Obviously, there are many patients with stable angina without recent documentation of the coronary anatomy who were not studied.

Fourth, no core laboratory analysis was performed of the qualifying coronary angiogram. Consequently, detailed anatomic information that might have influenced treatment decisions was lacking.

Finally, the present data have been acquired before clinical availability of drug-eluting stents. To what extent the availability of these devices will introduce a change in practice and treatment strategy will be examined in a new survey. Therefore the current results will serve as a benchmark for the evaluation of the effect of drug-eluting stents on the practice of revascularization.

Conclusions

In the hospitals that participated in the EHS-CR, treatment decisions in patients with stable coronary artery disease were largely in agreement with current guidelines. Most important deviations between guideline recommendations and clinical practice patterns were seen in patients with extensive coronary disease, those with impaired left ventricular function, and those with diabetes. The EHS-CR also revealed that treatment decisions in patients with stable coronary artery disease are determined by multiple factors. Interestingly, several of these factors were exclusion criteria in clinical trials that have been conducted in these patients, including prior revascularization, left main disease, renal failure, and heart failure. Thus to improve evidence-based

medicine, guidelines would need to account for this and incorporate specific recommendations regarding the best care for these specific patient subgroups.

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Appendix. Organization of the survey

Survey Expert Committee

W. Wijns (Survey Chairman), Belgium; N. Mercado (Research Fellow), The Netherlands; M. Bertrand, France; W. Maier, Switzerland; B. Meier, Switzerland; C. Moris, Spain; F. Piscione, Italy; U. Sechtem, Germany; P. Sergeant, Belgium; E. Stahle, Sweden; J. Vos, The Netherlands; P. Widimsky, Czech Republic; F. Unger, Austria.

Euro Heart Survey Team (European Heart House, France)

Malika Manini (Operations Manager); Claire Bramley (Data Monitor); Valérie Laforest (Data Monitor); Charles Taylor (Database Administrator); Susan Del Gaiso (Administrator).

National Coordinators

Austria: Kurt Huber; Belgium: Guy De Backer; Bulgaria: Vera Sirakova; Czech Republic: Roman Cerbak; Denmark: Per Thayssen; Finland: Seppo Lehto; France: Jean-Jacques Blanc, François Delahaye; Georgia: Bondo Kobulia; Germany: Uwe Zeymer; Greece: Dennis Cokkinos; Hungary: Kristof Karlocai; Ireland: Ian Graham, Emer Shelley; Israel: Shlomo Behar; Italy: Aldo Maggioni; Lithuania: Virginija Grabauskiene; The Netherlands: Jaap Deckers; Norway: Inger Asmussen; Poland: Janina Stepinska; Portugal: Lino Gonçalves; Russia: Vyacheslav Mareev; Slovakia: Igor Riecansky; Slovenia: Miran F. Kenda; Spain: Angeles Alonso, José Luis Lopez-Sendon; Sweden: Annika Rosengren; Switzerland: Peter Buser; Turkey: Tugrul Okay; Ukraine: Oleg Sychov; United Kingdom: Kevin Fox.

Euro Heart Survey Board Committee

David Wood (Chairman), United Kingdom; Angeles Alonso, Spain; Shlomo Behar, Israel; Eric Boersma, The Netherlands; Harry Crijns, The Netherlands; Kim Fox, United Kingdom; Malika Manini, France; Keith McGregor, France; Barbara Mulder, The Netherlands; Sylvia Priori, Italy; Lars Rydén, Sweden; Luigi Tavazzi, Italy; Alec Vahanian, France; Panos Vardas, Greece; William Wijns, Belgium; Uwe Zeymer, Germany.

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