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The EuroHeart Failure Survey programme—a survey on the quality of care among patients with heart failure in Europe

Part 2: treatment

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Background National surveys suggest that treatment of heart failure in daily practice differs from guidelines and is characterized by underuse of recommended medications. Accordingly, the Euro Heart Failure Survey was conducted to ascertain how patients hospitalized for heart failure are managed in Europe and if national variations occur in the treatment of this condition.

Methods The survey screened discharge summaries of 11 304 patients over a 6-week period in 115 hospitals from 24 countries belonging to the ESC to study their medical treatment.

Results Diuretics (mainly loop diuretics) were prescribed in 86.9% followed by ACE inhibitors (61.8%), beta-blockers (36.9%), cardiac glycosides (35.7%), nitrates (32.1%), calcium channel blockers (21.2%) and spironolactone (20.5%). 44.6% of the population used four or more different drugs. Only 17.2% were under the combination of diuretic, ACE inhibitors and beta-blockers. Important local variations were found in the rate of prescription of ACE inhibitors and particularly beta-blockers. Daily dosage of ACE inhibitors and particularly of beta-blockers was on average below the recommended target dose. Modelling-analysis of the prescription of treatments indicated that the aetiology of heart failure, age, co-morbid factors and type of hospital ward influenced the rate of prescription. Age <70 years, male gender and ischaemic aetiology were associated with an increased odds ratio for receiving an ACE inhibitor. Prescription of ACE inhibitors was also greater in diabetic patients and in patients with low ejection fraction (<40%) and lower in patients with renal dysfunction. The odds ratio for receiving a beta-blocker was reduced in patients >70 years, in patients with respiratory

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disease and increased in cardiology wards, in ischaemic heart failure and in male subjects. Prescription of cardiac glycosides was significantly increased in patients with supraventricular tachycardia/atrial fibrillation. Finally, the rate of prescription of antithrombotic agents was increased in the presence of supraventricular arrhythmia, ischaemic heart disease, male subjects but was decreased in patients over 70.
Conclusion Our results suggest that the prescription of recommended medications including ACE inhibitors and beta-blockers remains limited and that the daily dosage remains low, particularly for beta-blockers. The survey also identifies several important factors including age, gender, type of hospital ward, co morbid factors which influence the prescription of heart failure medication at discharge.

Introduction

Chronic heart failure (CHF) is a major health problem and is associated with a high morbidity and mortality.[1–3] Various national surveys have shown that medical management of CHF is characterized by polypharmacy and by the underuse of recommended medications.[4–6] Since 1997, the Guidelines of the European Society of Cardiology (ESC) have recommended routine use of ACE inhibitors and beta-blockers for the management of heart failure due to left ventricular systolic dysfunction, a recommendation that has recently been reinforced by further data from randomized trials and revised guidelines.[7] There is also a rapid change in the perception of heart failure management, based on recent trial evidence. The Euro Heart Failure programme is the first pan-European survey to describe the clinical profile and treatment of patients hospitalized for or with heart failure, a key event that provides an opportunity for improved diagnosis and treatment. The survey provides detailed information on how current recommendations are implemented in patients who have been hospitalized.

Patients and methods

A detailed description of the patient population and of the methodology used in this survey are provided in the diagnosis paper. In brief, 11 304 patients from 24 countries belonging to the ESC, including countries from Western, Eastern and Northern Europe and the Mediterranean, were enrolled with suspected or confirmed heart failure in 60 hospital clusters that included 116 hospitals. The average age was 71.3 years and 53% were males. Heart failure was recorded for the first time and the index admission in 27% of patients, whilst 56% of patients had a diagnosis of heart failure prior to the index admission. Seventy percent of patients had experienced at least one previous hospital admission in the 2 years preceding enrolment.

Table 1 Rate of prescription of the major heart failure medication in the overall population (n=11 016)

	(%)
ACE inhibitors	61.8 (40–85.1)
Angiotensin II receptor antagonists	4.5 (1.9–14)
Antithrombotic therapy (any)	77.6 (57.7–92.7)
Aspirin	29.1 (27.1–73)
Beta-Blockers	36.9 (10–65.8)
Calcium channel blockers	21.2 (9.8–33.4)
Cardiac glycosides	35.7 (17.3–53.5)
Diuretics	86.9 (64.2–96.4)
IV inotropic agents	7.2 (0.5–19.5)
Nitrates	32.1 (6.3–70.6)
Spironolactone	20.5 (5.7–58.5)

Methods

Modelling results for prediction of treatment on Euro heart data

In order to assess the relationship between variables and an outcome or 'event' and to consider associations in a multivariate context, we performed non-linear mixed models. Specifically, we used a logit link function and binomial error to identify any characteristics of patients which were predictive of different drug treatments. We exploited a hierarchical approach to data modelling in which clusters were defined as random effects.[8] Conditioning for country made no material difference to the results. All analyses were conducted using SAS 8.1.

Results

Table 1 gives the proportion of patients prescribed various major heart failure medications during hospitalization overall: diuretics were the most commonly prescribed treatment for heart failure (86.9%) followed by ACE inhibitors (61.8%), beta-blockers (36.9%), cardiac glycosides (35.7%), nitrates (32.1%), calcium channel blockers (21.2%)

Table 2 Drug therapy according to ejection fraction. Rate of prescription in percentage (when available)

	EF ≥40% (%) (*n*=3969)	EF <40% (%) (*n*=2248)	Difference	95% CI
ACE inhibitors	63.2	79.9	16.7	14.3 to 19.1
Angiotensin II antagonists	4.9	6	1.1	0 to 2.3
Beta-blockers	44.5	48.9	4.4	1.7 to 7.1
Calcium channel blockers	25.9	12.4	−13.53	−15.6 to −11.5
Digitalis	31.3	42.7	11.4	8.7 to 14.0
Diuretic agents (any)	83.2	87.9	4.7	2.8 to 6.6
Inotropic agents	7.1	11.1	4.0	2.4 to 5.6
Loop diuretics	75.4	82	6.5	4.3 to 8.7
Nitrates	47.1	48.3	1.2	−1.5 to 4.0

Note that patients who did not have left ventricular ejection fraction (LVEF) reported are not shown on this table. Patients who did not have LVEF measured were much less likely to receive an ACE inhibitor or beta-blocker.

Table 3 Names of diuretics, ACE inhibitors and beta-blockers prescribed. Data shown are percentages of total prescription in the whole population

Diuretics		ACE inhibitors		Beta-blockers	
Furosemide	87.7	Enalapril	34.9	Metoprolol	40.3
Spironolactone	23.6	Captopril	21.8	Atenolol	24.4
Thiazides	11.5	Ramipril	20.1	Bisoprolol	14.6
Amiloride	6.4	Perindopril	10.3	Carvedilol	13.1
Torasemide	3.9	Lisinopril	9.7	Sotalol	5.1
Bumetanide	3	Other	7.8	Other	9
Metolazone	1.3				
Triamterene	1.1				

and spironolactone (20.5%). Angiotensin receptor antagonists were not prescribed frequently for patients with heart failure. Only 17.2% of the population received the combination of a diuretic, an ACE inhibitor and a beta-blocker.

Table 2 gives the rate of prescription of major cardiovascular classes according to left ventricular ejection fraction (LVEF) when available (62% of patients). ACE inhibitors were more often prescribed when LVEF was reduced (79.0% when LVEF <40 vs 63.2% when LVEF >40%) as were cardiac glycosides (42.7 vs 31.3%). Calcium channel blockers were used more commonly in patients with preserved ejection fraction. The rate of prescription of diuretics and beta-blockers was similar in the two subgroups.

Agents and dosages

Table 3 gives the type of diuretic agent, ACE inhibitors and beta-blockers used and Table 4 provides the average daily doses prescribed at hospital discharge for these three classes.

Loop diuretics were by far the most commonly prescribed diuretics (94.7% of patients) followed by spironolactone (23.6% of patients), whereas the use of thiazide diuretics in this hospital population was low (11.5% of patients). Furosemide accounted for 87.7% of all diuretics prescribed and the daily dosage varied considerably. Fig. 1 gives the distribution of the daily dose of furosemide in the population. Over 40 of patients received 80 mg day^{-1} or more of furosemide. One-third of the patients received two or more diuretic agents. However, only 6.6% received the combination of a loop and a thiazide diuretic, whereas 18.8% received a loop diuretic and spironolactone.

The rate of prescription of these three first line CHF medications was studied across the participating countries. It was homogenous for diuretics (data not shown) (77.8 to 96.4% of patients) but important variations were found for ACE inhibitors and beta-blockers (Figs 2 and 3). The rate of prescription of cardiac glycosides (17.3 to 53.5% of patients), spironolactone (5.7 to 58.5%), nitrates (6.3 to 70.6%) varied also widely. Intravenous inotropic therapy was used in 7.2% of our patients, mostly dopamine (69.4%) and dobutamine (49.1%), with rates varying widely between centres (0.5 to 19.5%). Calcium channel blockers were used fairly often (9.8 to 33.4%). Amlodipine (37.9%), verapamil (22.5%) and diltiazem (20.3%) were the most common agents.

Table 5 gives the number of different heart failure medications used 70.6% of the patients were taking three or more and 44.6% four or more heart failure medications.

Influence of hospital wards, aetiology and age

The rate of prescription of ACE inhibitors and beta-blockers was influenced greatly by the type of hospital ward to which the patients was admitted.

Table 4 Daily dosage of the principal diuretics, ACE inhibitors and beta-blockers used in the survey when available

Diuretics (mg day^{-1})		ACE inhibitors (mg day^{-1})		Beta-blockers (mg day^{-1})	
Furosemide	86.4±75.2	Captopril	57.6±37.1	Metoprolol	74.9±43.3
Spironolactone	48.3±27.8	Enalapril	14.3±9.1	Atenolol	46.9±27.9
Toresamide	37.7±47.6	Lisinopril	12.3±7.8	Carvedilol	17.6±16.6
Amiloride	14.2±12.7	Ramipril	5.1±3	Bisoprolol	4.7±2.6
		Perindopril	3.1±1		

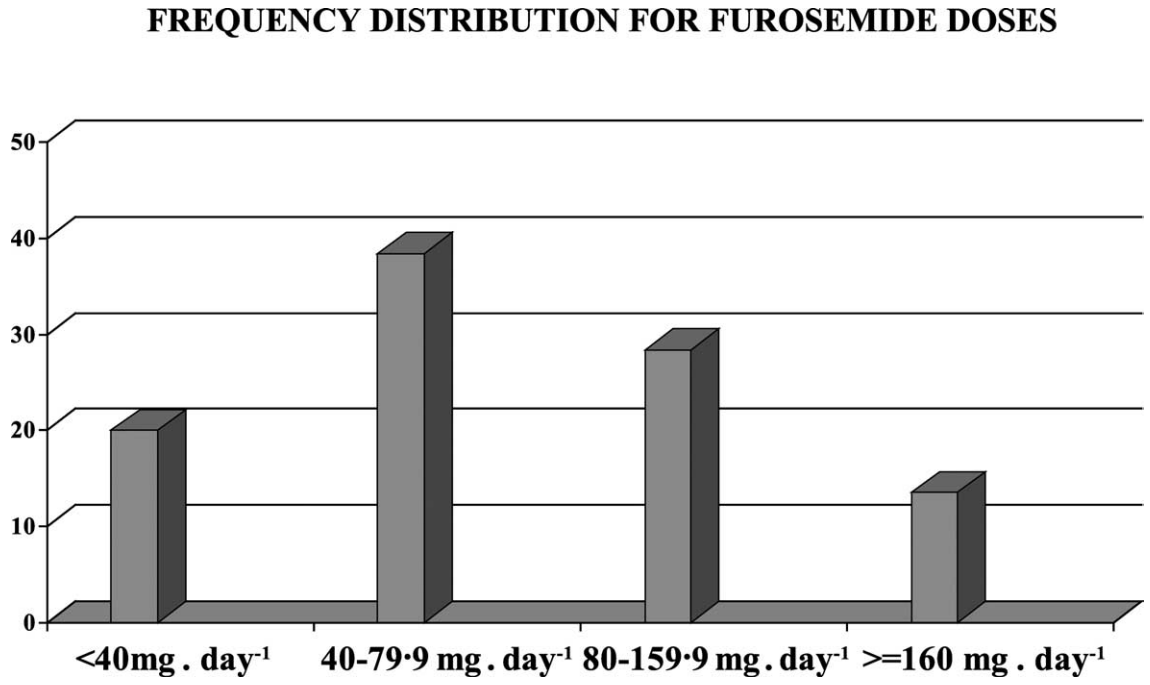

Fig. 1 Frequency distribution (in %) for furosemide doses (mg day^{-1}).

ACE inhibitors (71.5 vs 56.4% of patients) and beta-blockers (50.7 vs 26.3% of patients, odds ratio 2.69, 95% confidence interval 2.37 to 3.31) were more often used in patients receiving care in cardiology wards compared to general internal medicine wards (P<0.0001).

However, patients admitted to general internal medicine wards were older (71.7% of patients were aged ≥70 years compared to 46.8% on cardiology wards, 25.1% difference, 95% CI 23 to 27%) and had more co-morbidity (83.8 vs 73.8% of patients, 10% difference, 95% CI 8 to 12%).

ACE inhibitors and beta-blockers were prescribed more commonly in younger patients (67.7% of those aged <70 years vs 57.9% of those aged ≥70 years for ACE inhibitors, odds ratio 1.3, 95% CI 1.18 to 1.43); 47.4 of those aged <70 years vs 30% of those aged ≥70 years for beta-blockers, odds ratio 1.82, 95% CI 1.63 to 2.04.

The presence of ischaemic heart disease defined by current/previous myocardial infarction or angina was associated with a higher rate of prescription of beta-blockers (42.1% with vs 22.9% without IHD, odds ratio 2.63, 95% CI 2.32 to 2.99) and calcium channel blockers (25% with vs 11% without IHD, odds ratio 2.56, 95% CI 2.22 to 2.95). Similarly, the presence of a history of hypertension was associated with a higher rate of prescription of ACE inhibitors (69.2% with vs 53.4% without, P<0.0001) and beta-blockers (40.5% with vs 32.7% without, P<0.0001).

Role of co-morbidity

The presence of co-morbidity had a powerful influence on the rate of prescription of heart failure medications. Beta-blockers were prescribed only to

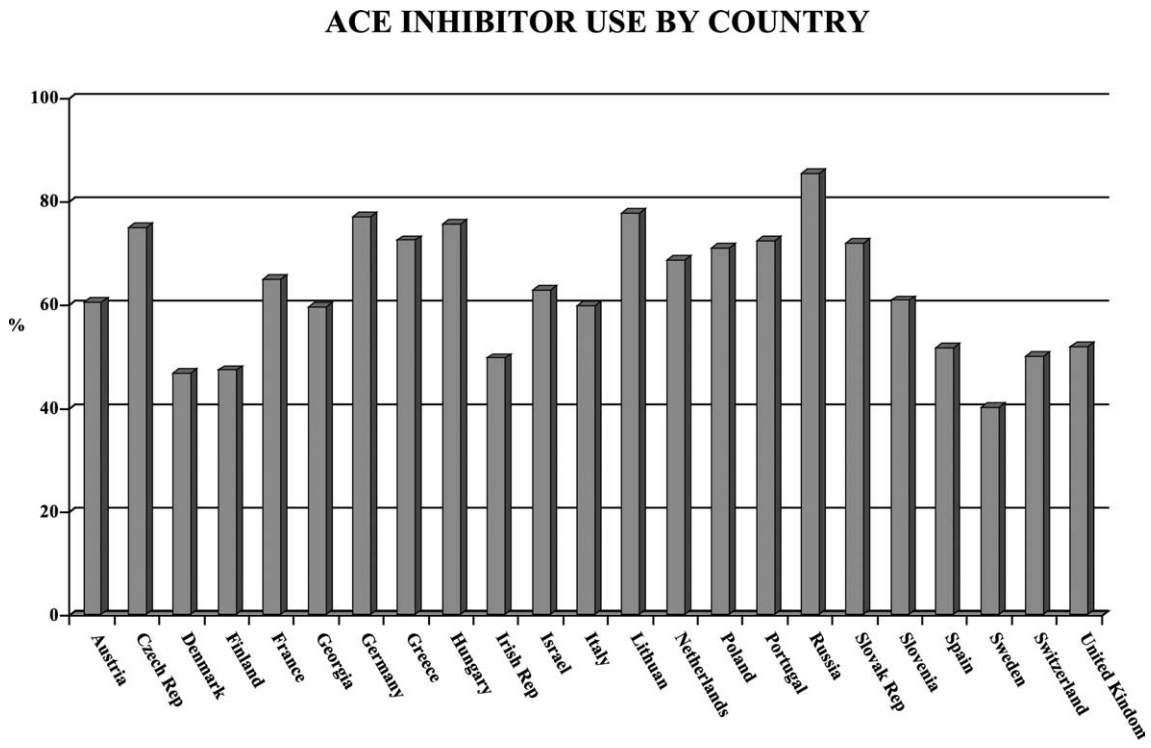

Fig. 2 Prescription rate of ACE inhibitors (in %) in the different countries participating in the survey.

19.1% of patients with a history of asthma or pulmonary disease as compared to 43.2% to patients without pulmonary disease, odds ratio 0.35, 95% CI 0.30 to 0.40. Renal dysfunction defined by a serum creatinine of 176 μmol l^{-1} (2 mg dl^{-1}) influenced the rate of prescription of ACE inhibitors (57% in patients with vs 66.3% in patients without renal dysfunction) 9.2% difference, 95% CI 4 to 14% (Table 6). There was no obvious difference in the average daily dosage of the most commonly prescribed ACE inhibitors according to renal function (Table 7). Renal dysfunction also influenced the rate of prescription of spironolactone (15.6% with vs 22% without, difference, −6.4, 95% CI −10 to −2%). However, the effect of renal dysfunction on the use of ACE inhibitors and spironolactone disappeared in a multivariate analysis (see below) suggesting that other factors associated with renal dysfunction may have had an important effect on prescribing patterns.

ACE inhibitors were more commonly prescribed in diabetic patients (67.6 vs 59.7%, 7.9% difference, 95% CI 6 to 10%) whereas beta-blockers were not (36.6 vs 36.9%). Both beta-blockers (24.8 vs 37.2%) and ACE inhibitors (49.6 vs 62%) were less likely to be prescribed in patients with a recent history of stroke.

Antithrombotic therapy, either an antiplatelet or anticoagulant agent, was used in 77.6% of the patients (ranging from 57.7 to 92.7% in different countries). The rate of prescription was influenced by the presence of atrial fibrillation/supraventricular tachycardia (82.7 with vs 74% without, odds ratio 2.86, 95% CI 2.41 to 3.39) and the presence of ischaemic heart disease (82.3 with vs 65.2% without, odds ratio 2.96, 95% CI 2.51 to 3.50). The average daily dosage of aspirin was 114±57 mg.

Anticoagulant therapy was more likely to be prescribed in the presence of AF/SVT (59.4%) than in the absence of arrhythmia (33.4%, 22% difference, 95% CI 20 to 24%).

Digitalis glycosides were more likely to be used in the presence of atrial fibrillation or supraventricular tachycardia (56.2 with vs 20.9% without, odds ratio 5.50, 95% CI 5.02 to 6.03).

Multivariate analysis (Table 8)

Beta-blockers

In a multivariate model, the odds of the patient receiving a beta-blocker were increased if the admission was to a cardiology ward rather than a general ward (odds ratio 2.69, 95% CI 1.05 to 1.29) and were also independently increased for patients suffering from ischaemic heart disease (odds ratio 2.63, 95% CI 2.32 to 2.99). Odds were decreased in the presence of respiratory/pulmonary disease

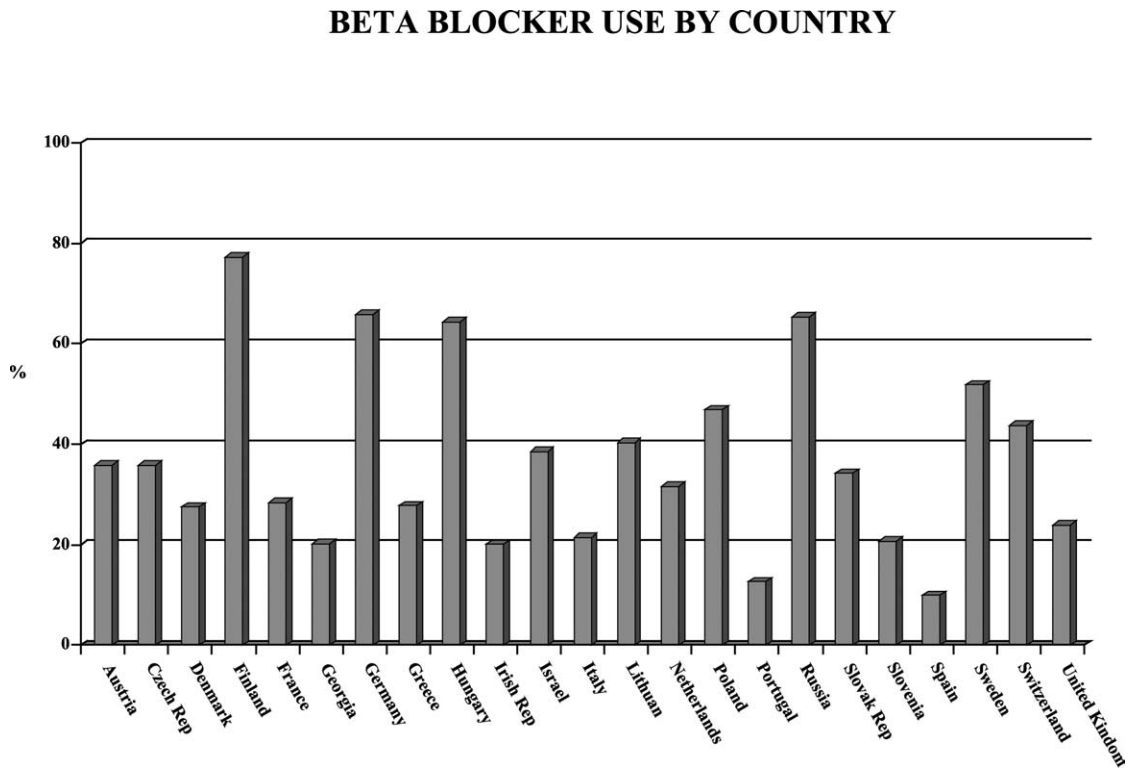

Fig. 3 Prescription rate of beta-blockers (in %) in the different countries in the survey.

Table 5 Number of cardiovascular medications used at baseline (among diuretics, ACE inhibitors, beta-blockers, nitrates, cardiac glycosides, calcium channel blockers, spironolactone or angiotensin II receptor antagonists)

Number of drugs	%
1	9.8
2	18.3
3	26.0
4	24.5
≥5	20.1

Table 6 ACE inhibitor use according to comorbidity

	%	*P* value
Age >70 years	67.7	<0.0001
Age ≤70 years	57.9	
Diabetes		
yes	67.6	<0.0001
no	59.7	
Ischaemic heart disease		
yes	67.7	<0.0001
no	46.1	
Stroke		
yes	49.6	<0.0001
no	62	
Renal dysfunction		
yes	57	<0.0001
no	66.3	
Any of previous		
yes	62	=0.026
no	58	

(odds ratio 0.35, 95% CI 0.30 to 0.40) and for patients aged ≥70 (odds ratio 0.55, 95% CI 0.49 to 0.61).

ACE inhibitors

A multivariate model for ACE inhibitor treatment showed that the odds of receiving an ACE inhibitor were increased for male patients (odds ratio 1.34, 95% CI 1.22 to 1.48) and for patients with ischaemic heart disease (odds ratio 2.35, 95% CI 2.21 to 2.71). Older patients (over 70 years of age) had reduced odds of ACE inhibitor treatment (odds ratio 0.77, 95% CI 0.70 to 0.85) (Table 8). Univariate factors including renal dysfunction, diabetes, respiratory disease influenced the outcome of whether the patient received an ACE inhibitor. However, when variables were considered together the effects of these particular factors did not account for any additional variation in the results and so were not included in the final model.

Table 7 Average daily doses of ACE inhibitors according to presence/absence of renal dysfunction. Daily dose (mg day^{-1}, mean±SD)

ACE inhibitor	Renal dysfunction	No renal dysfunction
Captopril	52.1±34.7	58.5±37.7
Enalapril	13.5±8.6	14.2±9
Ramipril	4.8±3.1	5±2.9

Spironolactone

In a multivariate model, the odds of the patient receiving spironolactone were increased if the admission was to a cardiology ward rather than a general ward (odds ratio 1.61, 95% CI 1.31 to 1.99), for male patients compared with female patients (odds ratio 1.28, 95% CI 1.15 to 1.43) and were also independently increased for patients suffering from supraventricular tachycardia or arrhythmia (odds ratio 1.39, 95% CI 1.25 to 1.56). Odds were decreased in the presence of ischaemic heart disease (odds ratio 0.78, 95% CI 0.66 to 0.92), for patients aged 70 and over (odds ratio 0.76, 95% CI 0.67 to 0.85) and for those who had suffered a stroke.

Patients with ischaemic heart disease who had been admitted to cardiology wards were less likely to receive spironolactone (odds ratio 0.68, 95% CI 0.54 to 0.87) but more likely to receive spironolactone if they had also had a stroke (odds ratio 5.31, 95% CI 1.13 to 25.05).

Calcium channel blockers

Men were less likely than women to receive calcium channel blockers (odds ratio 0.79, 95% CI 0.71 to 0.88) and the odds were also reduced for patients admitted to cardiology wards rather than general internal medicine wards (odds ratio 0.88, 95% CI 0.78 to 0.99). The odds of receiving calcium channel blockers were independently increased for patients with ischaemic heart disease (odds ratio 2.56, 95% CI 2.22 to 2.95).

Antithrombotics and aspirin

The odds of a patient receiving an antithrombotic agent (including aspirin) were increased by the presence of SVT/AF (odds ratio 2.86, 95% CI 2.41 to 3.39) and by the presence of ischaemic heart disease (odds ratio 2.96, 95% CI 2.51 to 3.50). The odds for male patients were independently higher than for female patients (odds ratio 1.19, 95% CI 1.00 to 1.40) but were decreased for patients over the age of 70 (odds ratio 0.80, 95% CI 0.72 to 0.89). Men with ischaemic heart disease were more likely to receive an antithrombotic agent (odds ratio 1.37, 95% CI 1.12 to 1.69). Patients with ischaemic heart disease were less likely to receive antithrombotic therapy if they also had SVT/AF (odds ratio 0.52, 95% CI 0.42 to 0.64) (Table 8).

An analysis of factors predicting treatment with aspirin showed that odds were increased for patients aged over 70 years (odds ratio 1.92, 95% CI 1.57 to 2.34) and for male patients (odds ratio 1.34, 95% CI 1.23 to 1.46). Patients with ischaemic heart disease had higher odds of receiving aspirin (odds ratio 5.67, 95% CI 4.78 to 6.72) especially if they were men (odds ratio 1.66, 95% CI 1.39 to 1.99). The presence of SVT/AF reduced the odds of treatment with aspirin both in isolation (odds ratio 0.44, 95% CI 0.38 to 0.51) and further in combination with ischaemic heart disease (odds ratio 0.44, 95% CI 0.36 to 0.54.

Discussion

Categories of medication

Previous surveys suggest that guidelines for the pharmacological treatment of chronic heart failure are not closely adhered to.[4–6] This survey suggests that although prescription of ACE inhibitors and beta-blockers may be increasing, they still remain underused, both in terms of the proportion of patients receiving them and the doses employed. This applies particularly to beta-blockers. Only 17% of our population received the recommended triple association: diuretic, ACE inhibitor, beta-blocker. The experience described in this survey reflects recommendations from Guidelines published in 1997,[9] as well as new knowledge obtained during 1997–2001 expressed in the more recent version from 2001.

In the EPICAL study, which gathered information on hospitalization in patients with severe heart failure due to left ventricular systolic dysfunction during 1995 in Eastern France, 75% of patients were receiving ACE inhibitors but only 5% beta-blockers at discharge.[10] The patient population was younger than patients enrolled in our survey and consisted mainly of males. The IMPROVEMENT of Heart Failure survey enrolled >10 000 patients in primary care in 14 European countries during 1999. The composition of this population, in terms of age, gender, and left ventricular systolic dysfunction, was remarkably similar to the current survey, reflecting the high rates of hospitalization amongst patients with heart failure. In the IMPROVEMENT survey, 60% of patients were prescribed an ACE inhibitor, 30% a beta-blocker and 12% spironolactone.[11] In a large survey of patients hospitalized

Table 8 Modelling analysis of the prescription of treatment. In all tables, results are presented as OR±95% CI

	Odds ratio (95% CI)
Beta-blockers	
Factor	
Respiratory/pulmonary disease	0.35 (0.30 to 0.40)
Speciality at admission (Cardiology vs GIM, for being Cardiology)	2.69 (2.37 to 3.31)
IHD	2.63 (2.32 to 2.99)
Age group (>70)	0.55 (0.49 to 0.61)
Gender (being male)	1.16 (1.05 to 1.29)
Cardiac glycosides	
Factor	
SVT/AF	5.50 (5.02 to 6.03)
Calcium channel blockers	
Factor	
IHD	2.56 (2.22 to 2.95)
Gender (being male)	0.79 (0.71 to 0.88)
Speciality at admission (cardiology vs GIM, for being Cardiology)	0.88 (0.78 to 0.99)
Antithrombotic agents	
Factor	
Age (>70)	0.80 (0.72 to 0.89)
Gender (being male)	1.19 (1.00 to 1.40)
SVT/AF	2.86 (2.41 to 3.39)
IHD	2.96 (2.51 to 3.50)
IHD*Gender	1.37 (1.12 to 1.69)
IHD*SVT/AF	0.52 (0.42 to 0.64)
ACEi	
Factor	
Age (>70)	0.77 (0.70 to 0.85)
Gender (being male)	1.34 (1.22 to 1.48)
IHD	2.45 (2.21 to 2.71)
Spironolactone	
Factor	
Age group (>70)	0.76 (0.67 to 0.85)
Speciality at admission (Cardiology vs GIM, for being Cardiology)	1.61 (1.31 to 1.99)
IHD	0.78 (0.66 to 0.92)
SVT/AF	1.39 (1.25 to 1.56)
Gender (being male)	1.28 (1.15 to 1.43)
Stroke	0.10 (0.02 to 0.45)
Speciality at admission *IHD	0.68 (0.54 to 0.87)
Stroke *IHD	5.31 (1.13 to 25.05)
Aspirin	
Factor	
Age (>70)	1.92 (1.57 to 2.34)
Gender (being male)	1.34 (1.23 to 1.46)
SVT/AF	0.44 (0.38 to 0.51)
IHD	5.67 (4.78 to 6.72)
IHD*Gender	1.66 (1.39 to 1.99)
IHD*SVT/AF	0.44 (0.36 to 0.54)

SVT=supraventricular tachycardia; AF=atrial fibrillation; IHD=ischaemic heart disease.

for chronic heart failure in cardiology, general medicine and geriatric departments in France, only 49 and 11% of patients received an ACE inhibitor and a beta-blocker respectively on admission.[4] Similar trends were found in two recent surveys in Australia and France.[5,12] In the Australian study, 58.1% of patients only were receiving ACE inhibitors and 12% beta-blockers. In the French survey performed among ambulatory patients in private practice, the respective numbers were 54 and 11%. However, most of these surveys included relatively small numbers of patients (500–1000) and were performed on a national basis. The Euro Heart Survey on heart failure is the first pan-European Survey in hospitalized patients.

Diuretics and particularly loop diuretics were by far the most commonly used heart failure medications in this survey. Although entry criteria may have influenced the results, our findings are in agreement with previous surveys.[4–6,12] There was little variation from one centre to the other in the rate of prescription of diuretics. This finding

contrasts with the important variations found in the rate of prescription of both ACE inhibitors and beta-blockers. However, it should be emphasized that these variations are individual centre variations and therefore only partly reflect the current situation in ordinary practice in a given country. It is likely that variation between centres within each country are also large.

The rate of prescription of ACE inhibitors reached 80% in patients with documented reduction in ejection fraction, which indicates that the situation is improving as compared to previous surveys. In contrast, beta-blockers were clearly under-prescribed even in patients with a documented low ejection fraction.

Various factors can explain the under use of ACE inhibitors and beta-blockers:

1. Underestimation of the morbidity and mortality of the syndrome.
2. Underestimation of the magnitude of the benefit brought about by these classes.[13]
3. Concern on the potential adverse reactions. For instance, in a survey among UK general practitioners, nearly half of the participants expressed concern about adverse effects related to initiation of ACE inhibitors.[14] However, our survey was not designed to study the reasons for non-prescription of recommended drugs.
4. The clinical profile of the patient: in our survey, the likelihood of receiving an ACE inhibitor or a beta-blocker was dependent on the age of the patients. Patients aged ≥70 years were less likely to receive either class of agent. Co-morbidities, such as asthma or pulmonary disease reduced the prescription of beta-blockers. Other co-morbidities, such as diabetes led to increased usage of ACE inhibitors. Both classes of drugs were less commonly used in the setting of a recent stroke but this survey was prior to the publication of the PROGRESS study, which suggested a beneficial effect of tight blood pressure control in patients with stroke.[15] Similarly, the rate of utilization of antithrombotic agents and cardiac glycosides was significantly increased in the presence of atrial fibrillation or supraventricular tachycardia.
5. The aetiology of chronic heart failure: the presence of ischaemic heart disease increased the rate of prescription of aspirin and beta-blockers. Both ACE inhibitors and beta-blockers were used more frequently in hypertensive patients.
6. Speciality at admission: the medical specialty responsible for patient care influenced the rate of prescription of recommended drugs. In our survey, both drugs were significantly more prescribed in cardiology wards than it internal medicine wards, although this may have more to do with the greater age and co-morbidity of patients cared for in medical wards. In a Germany study, it was shown that both ACE inhibitors and beta-blockers were less prescribed in a rural than in a metropolitan hospitals potentially reflecting the benefits of specialization.[6]
7. The pathophysiology of heart failure: many patients in the Euro Heart Failure survey had preserved left ventricular systolic function, a condition for which there is little evidence that treatment alters outcome. ESC guidelines indicate that recommendations are largely speculative. The results of several large randomized trials are awaited.[16] The high proportion of patients with 'diastolic dysfunction'—often due to hypertension—not only help explain the underuse of beta-blockers and ACE inhibitors but also the high rate of use of calcium channel blockers which are not recommended or contraindicated for the treatment of heart failure with systolic dysfunction.

Treatment directed at ischaemic heart disease, rather than at heart failure, probably explains why the prescription of beta-blockers was not even lower and also explains the high rate of use of calcium channel blockers and nitrates, agents for which there is little evidence of benefit in patients with left ventricular systolic dysfunction. Spironolactone was prescribed in more than 20% of our overall population and even more commonly in the absence of renal dysfunction, suggesting that the conclusions of the RALES study have been accepted in Europe.[17] Angiotensin II receptor antagonists were used only in a minority of patients, reflecting uncertainty over the role of these agents as an alternative or in addition to ACE inhibitors.[18,19] ESC guidelines do not advise the use of this class of drugs as first line therapy.

Cardiac glycosides, an 'old fashioned' heart failure medication which has only been demonstrated to reduce the rate of hospitalizations for patients in sinus rhythm[20] but which may continue to have a role for patients with atrial fibrillation was still used in about a third of our population, including 21% of those without supraventricular arrhythmia. In most ESC countries, more patients with heart failure now receive beta-blockers than receive digoxin.

Dosage and preparations

Daily dosage of diuretics varied considerably but many patients received high doses suggesting that many had advanced heart failure.

The most commonly prescribed ACE inhibitors were used at doses equal to or greater than 50% of the doses used in randomized trials except for captopril, which was used in doses substantially lower than target. This suggests that guideline recommendations are being followed in great part. Since we did not record the reason for using a given dosage of a drug, we are unable to assess whether dosing was limited for reasons of safety or tolerance or because of lack of attention by the physician. Our patients were, on average, considerably older than the patients in the clinical trials. Most ACE inhibitors are eliminated mainly be the kidneys and lower doses may be justified in elderly patients as they have reduced renal clearance. Although the ATLAS trial showed that higher doses of an ACE inhibitor, lisinopril, were associated with some improvement in morbidity[21] there is no robust evidence that high doses of ACE inhibitor are of benefit to very elderly patients (aged >75 years) with heart failure.

On average, daily dosage of beta-blockers were far below the target doses used in randomized trials. It is possible that many patients were still in the process of having the dose of beta-blocker uptitrated but it is also probably reflects caution on the part of clinicians and the absence of a substantial dose-ranging study to show the relative benefits and problems of titrating to higher doses. Atenolol, for which no substantial trial in heart failure exists[22] and which does not have a license for this indication, constituted nearly 25% of all beta-blockers prescribed, the choice of this agent probably reflecting its use to treat underlying problems, such as ischaemic heart disease or hypertension.

Overall, our results suggest that the application of modern therapeutic guidelines has improved compared to that previously reported in smaller national surveys.

Limitations

We acknowledge that Euro Heart Survey on Heart Failure was concentrated on University hospitals clustered with one or more community hospitals. This design might have resulted in an over representation of metropolitan hospitals vs rural healthcare units. Therefore, the Euro Heart Survey on Heart Failure is not a true epidemiological survey representative of the overall population but rather a large hospital-based European data base.

In summary

We report here the detailed analysis of treatments used in the Euro Heart Survey on Heart Failure. Diuretics were the most commonly prescribed class of agent. Overall, ACE inhibitors were used in 61% of patients and almost 80% of those with reduced left ventricular ejection fraction. The respective figures for beta-blockers were less widely used overall (37%) and in patients with reduced left ventricular ejection fraction (49%). Daily dosages of ACE inhibitors reached 50–60% of the target recommended dose except for captopril, which was prescribed at much lower doses, whereas the daily dosage of beta-blockers were far below the target dose used in randomized trials.

Many factors including age, aetiology of heart failure, co-morbidity, specialty at discharge and pathophysiology of heart failure influenced the rate of prescription of the recommended drugs. Overall, our results suggest that the situation is improving for ACE-inhibitor prescription but remains suboptimal for beta-blockers. Continued medical education and improved organisation of services are required to improve the dissemination and uptake of guidelines on treatment of chronic heart failure in daily practice.

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