Clinical research

Patient differences related to management in general practice and the hospital: a cross-sectional study of heart failure in the community

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Aim To compare patients treated for heart failure in relation to the management in general practices versus hospital admission.

Methods and results Twelve randomly selected general practices (GP) were screened for patients receiving ACE-inhibitor, digoxin, or loop diuretic treatment. The first 500 volunteers of 959 potential subjects were invited to a cardiac examination after exclusion of 235 frail, physically or mentally disabled patients. A diagnosis of heart failure during hospital admission (Hospital-HF, n = 102) was more related (p < 0.05) to male sex (45% vs. 21%), advanced age (73 vs. 70 years), breathlessness (75% vs. 62%), LV systolic dysfunction (47% vs. 20%), objective cardiac abnormality (92% vs. 65%) and higher 4-year mortality (33% vs. 15%) than patients taking loop diuretics due to signs and symptoms of heart failure in GP (GP-HF). Patients without clinical heart failure (n = 301) had the same survival but less symptoms and cardiac abnormalities than GP-HF patients.

Conclusion A surplus morbidity and mortality was related to a hospital-based rather than a GP based diagnosis of HF. Patients managed in GP were different from patients entering previous clinical trials of heart failure. We estimate that the pool of patients hospitalised with systolic heart failure would be increased from 1.3 to 1.4 more if all patients from primary care were included.

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KEYWORDS
Congestive Heart Failure; Mortality; Left ventricular systolic dysfunction; Management; Community patients

Introduction

In the past 10 years, several epidemiological investigations of heart failure and left ventricular systolic dysfunction have been conducted in Europe. The current medical therapy is a result of large randomised clinical trials including hospitalised patients. Population surveys have estimated the prevalence of LV systolic dysfunction to be 3–4% in the general population over 50 years of age.1–4 Half were symptomatic and therefore meeting the criteria for heart failure as created by the Working...
Group on Heart Failure of the European Society of Cardiology (ESC). In Europe, it is generally believed that patients with heart failure are managed mostly in the community by primary care physicians. Such physicians have a key role in early identification, adequate assessment, and optimum treatment of heart failure.

In the pan-European IMPROVEMENT study most patients with heart failure were appropriately investigated but that study mainly looked at patients in whom the primary care physicians were confident of the diagnosis. Very few studies have objectively characterised patients that were treated for the signs and symptoms of heart failure in primary care without being referred to a secondary physician. Previous studies indicate that only 20–50% of such patients from primary care would actually have heart failure due to LV systolic dysfunction.

Extrapolating from previous studies we hypothesised that patients with a clinical label of heart failure from primary care would have less cardiac abnormalities, a better survival and therefore not the same benefit of medical treatment as hospitalised patients.

Unfortunately, very few studies provide objective information about the patients that are solely treated by primary care physicians. Knowing these issues would help to estimate how many patients in general practice would have heart failure according to modern criteria, their mortality risk, and how many are deprived of an effective medical treatment. The aim of the present work was to compare clinical and aetiological aspects of patients treated for heart failure in the community and to examine the effect of whether the heart failure label was attained in general practice or during a hospital admission.

Methods

Population and screening methodology

A heart failure nurse screened 15 randomly selected general practices (GP) in North Glasgow to identify all patients taking ACE-inhibitor, digoxin, or loop diuretic agents. The initial screening step was a computerised drug search performed on July 5, 1995. In the second step, the nurse reviewed all GP case notes to look for more information about clinical and objective signs of heart failure. The nurse consulted the patient’s own general practitioner before the patient could be considered eligible for a cardiac examination in a hospital-based clinic.

Inclusion and exclusion criteria

The drug search resulted in 1194 subjects. After consultation with the general practitioners 235 subjects were excluded from further investigation because they were dead (n = 25), too frail, hospitalised, or residing in a nursing home (n = 173), had moved away from Glasgow (n = 12) or had attended another screening study (n = 25). According to the protocol only 500 subjects were planned to undergo extensive examination and these were selected as the first 500 subjects of the remaining 959 eligible subjects who would accept the invitation. The target of 500 was considered large enough to represent different practices and to contain at least a 100 subjects with LV systolic dysfunction provided the prevalence would be at least 20% of systolic dysfunction. Screening ceased on July 1996 when the target of 500 examined patients had been reached.

Criteria of heart failure

The present criteria had to circumvent the fact that general practitioners did not systematically write down explicit diagnosis for their patients. Obviously GPs would be more confident of the diagnosis if a patient had been referred to and investigated in a hospital (Hospital-HF). But since all patients have not been referred, many patients are treated for the signs and symptoms of heart failure solely by the clinical judgment of the GP (GP-HF). Instead of asking the GP about the final diagnosis, we allocated patients to the GP-HF group according to the GPs description of symptoms and subsequent treatment as inferred from review of GP case notes. Patients who could not be classified as Hospital-HF or GP-HF were considered as a reference group without any sign of heart failure (non-HF). The following definitions were used.

Hospital-HF was diagnosed in the case of a history of breathlessness, swollen ankles, fluid retention, or an abnormal chest X-ray in a patient in combination with a current prescription of a loop diuretic. An abnormal chest X-ray was a cardiothoracic ratio (CTR) > 50%, enlarged left ventricle, pleural effusion, upper lobe venous diversion, or interstitial or alveolar oedema. As it was a clinical label there was no requirement of an objective determination of cardiac function or an explicit diagnosis according to the ESC criteria, but it was noted whether these issues had been mentioned in the record.

Non-HF patients were defined as the remaining subjects who received heart failure therapy but did not meet the criteria for Hospital-HF or GP-HF.

Questionnaire and routine tests

A self-reported questionnaire was obtained for all subjects giving details of physician diagnosed angina, myocardial infarction, diabetes, stroke, drug therapy, and answers to the Medical Research Council (MRC) Breathlessness questions. Hypertension was based on self-report or a measured systolic blood pressure > 160 mmHg or diastolic > 95 mmHg using a random zero sphygmomanometer (mean of two readings). Pulmonary function tests were performed and airway obstruction defined as a FEV1/FVC < 0.7 or FEV1 < 1.5 litre. Plasma BNP was measured by use of the Shionogi assay (Shionoria, Japan).

Electrocardiography

The standard 12-lead electrocardiograms (ECGs) were coded independently to other data. A left bundle branch block (LBBB), wide QRS (≥ 0.12 s), pathological Q waves, major ST/T segment abnormality, or left ventricular hypertrophy (LVH) were noted in that order (see legend of Table 3 for definitions). Borderline findings were adjudicated by consensus.

Echocardiography

Left ventricular ejection fraction (EF) was calculated by the Bi-plane Disc Summation Method (Simpson’s Rule). An EF < 0.35 was significantly reduced as it refers to the 2.5th percentile of

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EF in normal elderly subjects. Left ventricular systolic function was also evaluated by the 9 segment model for assessing the wall motion index score (WMI),\textsuperscript{13,14} where LV systolic dysfunction (LVSD) was defined as WMI <1.5 (approximately EF <0.45) and a normal systolic function was defined as WMI $\geq 1.8$.

Follow-up

The date and cause of death was identified by flagging each patient's record with the Registrar General for Scotland on December 31, 2000.

Data analysis

Differences between study groups were evaluated by a \( \chi^2 \) test using the Yates contingency correction. Variables of rank were examined by the Kruskall–Wallis test. Two-tailed tests of significance are reported and \( p \)-values below 0.05 are considered statistically significant.

Survival was estimated using the method of Kaplan–Meier, and differences in survival between groups were evaluated by the log-rank test. Paired comparison showed no difference in survival between the reference group and GP-HF so these were grouped together. A Cox proportional hazards model evaluated the effect of GP-HF on mortality after adjusting for sex and age. The assumption of proportional hazards between Hospital-HF and the rest was assessed by visual judgment of the logarithm of minus logarithm of the survival estimates adjusted for age and sex.

Results

Prevalence of heart failure

The target of 500 examined subjects was reached when 830 of the 959 eligible subjects had been invited, so 129 were never asked to participate. This results in a participation rate of 60\% (500/830) where 330 of 830 had declined the invitation. Reasons for declining were illness or frailty (\( n = 96 \)), not given (\( n = 215 \)) and lost contact (\( n = 19 \)). Twelve consecutive practices with a total case-load of 30 000 patients had been screened when the target of 500 subjects was reached. Of the 500 examined patients 97 were thought to have heart failure in the hospital, while 301 had no documentation of heart failure. The crude prevalence of heart failure in the community was 1.6\% (199/500 $\times$ 1194/30 000) with 95\% confidence limits (CI) from 1.4\% to 1.7\%. As in all epidemiological studies this tentative figure is based on the controversial assumption that examined and unexamined patients are comparable.

Clinical characteristics

One would expect to find more symptomatic and more severe patients in the hospital group, while those with milder and more controllable symptoms would be managed in the GP. Table 1 shows that half the heart failure patients were managed in a hospital, and these were older, had more symptoms and more self-reported heart disease.

A surprisingly large majority of the GP-HF patients were women. Compared with the non-HF group both heart failure groups were older, had more reported cases of breathlessness, ischaemic heart disease, smokers, and obstructed airways, but less documented hypertension (\( p < 0.05 \)).

Objective documentation of heart failure

Original data regarding the possible mechanism of heart failure are presented in Tables 2 and 3. Hospital-HF patients had significantly more abnormal hearts (84\%) than the GP-HF (56\%) and non-HF group (43\%). The GP-HF group had more of atrial fibrillation and enlarged atrium as compared with the non-HF group. Table 3 shows that only 5\% (four patients) of Hospital-HF had no obvious reason for the symptoms, as compared with 13\% of the GP-HF and 25\% of the non-HF group. Considering all the heart failure patients, 33\% had significant LVSD while 30\% had a completely normal LV function with no valvular disease, no LV hypertrophy or atrial fibrillation.

Plasma BNP concentrations were significantly higher (\( p = 0.01 \)) in Hospital-HF (median 78, IQR from 40 to 167 pg/ml) than GP-HF patients (median 45, IQR from 19 to 116 pg/ml). GP-HF patients again had higher (\( p = 0.04 \)) values than non-HF patients (median 32, IQR from 14 to 76 pg/ml).

Management of heart failure

Table 4 shows that the GP case notes already contained evidence of cardiac disease in 95\% of Hospital-HF and 64\% of GP-HF. Only 45\% of GP-HF patients had a previous cardiac function test performed compared with 93\% of the Hospital-HF group. The data does not indicate why only 45\% were referred to an objective test or if the GPs thought such a test would be unnecessary. There was no difference in the use of chest X-rays or ECGs between non-HF and GP-HF patients.

ACE-inhibitors were used in half the Hospital-HF patients but only in 16\% of GP-HF, who, by definition, all received a loop diuretic. Hospital-HF patients used digoxin more than could be explained by the prevalence of atrial fibrillation.

Mortality

About 44 of non-HF patients, 14 of GP-HF, and 34 of Hospital-HF died during the follow-up period with a median time of 3.5 years. Fig. 1 shows that GP-HF and non-HF patients both had a 4-year mortality of 15\% (pair-wise log rank test, \( p = 0.99 \)), significantly less than 33\% in the Hospital-HF group (pair-wise log rank test, \( p < 0.001 \)). In a Cox regression model, there was an independent prognostic value of age (HR = 1.6 per 10-year, 95\% CI from 1.3 to 2.0, \( p < 0.001 \)) and Hospital-HF (HR = 1.9, 95\% CI from
1.2 to 3.0, \( p = 0.007 \), but not of GP-HF (Hazard ratio = 0.9, 95% CI from 0.5 to 1.7, \( p = 0.76 \)) or sex (HR = 1.5 for male, 95% CI from 1.0 to 2.3, \( p = 0.067 \)). No other variables were tested in this model. There was a non-significant decrease of hazard with time, meaning that risk of Hospital-HF in the first 1–2 years after examination might have been slightly underestimated.

Discussion

Main results

This study demonstrates that about 20% of the patients treated for heart failure by the GPs have significant LV systolic dysfunction making them comparable to patients entering clinical trials of congestive heart failure, and additional 10% had valvular dysfunction. Thus, in addition to the pool of well described and recognised patients with hospitalised heart failure, about 30–40% more are to be found in primary care, which may be fewer than generally believed. The rest of patients with symptoms and treatment of heart failure in general practice do not comply with criteria for current medical therapy of heart failure; they have a better survival and may not have the same absolute benefit of treatment.

This large descriptive study of patients receiving heart failure medication in the community gives some insight into the sort of patients thought to have heart failure in general practice. It documents that more severe cases of heart failure are being referred to the hospitals, and these patients are most comparable to the heart failure patients included in the randomised clinical trials with respect to a high proportion of LV systolic dysfunction, ischaemic heart disease, and male sex.

Other studies

The prevalence and characteristics of heart failure in the community are described in at least six studies, but two did not include echocardiography,\(^7,8\) and three performed echocardiography in only a proportion of their patients.\(^4,9-11\) With respect to clinical characteristics of patients with suspected heart failure in general practice all studies agree that:\(^4,7,15,16\) the majority are women, only 1 in 5 have LVSD,\(^4,16-18\) 10% have valvular...
disease, and half have a normal function and structure of the left ventricle and atrium. In this study half the heart failure patients had been hospitalised, while other studies reported from one-third to three-quarters. Loose criteria for getting a clinical label of heart failure in general practice may explain these differences. Less than 10% of hospitalised HF patients had alternative explanations for heart failure symptoms, which compares with 9% in another study.

The gradual increase of BNP across subgroups support the finding of increased echocardiographic cardiac...
abnormalities from non-HF to GP-HF and Hospital-HF. But concentrations are also affected by age and treatment so further analyses about the diagnostic/prognostic value will be reported in other papers.

The 1.6% overall prevalence of suspected or documented heart failure is in line with other population-based studies. Assuming 40% of these have systolic dysfunction, then the prevalence of heart failure due to systolic dysfunction will be about 0.6–0.7%, which is consistent with the estimates in other studies from England and Copenhagen.

Management

Management of heart failure in the community was only described in a few other studies. The European IMPROVEMENT Survey indicated that most patients with heart failure are appropriately investigated, although this finding might be a result of high rates of hospital admissions. The present study supports the idea that referred patients have been adequately investigated while those suspected of heart failure in general practice were not. The use of chest X-rays and electrocardiograms were comparable to another study from the UK. Just 65% of the GP-HF group had documentation of a cardiac function test performed. The use of ACE-inhibitors was low when compared to the number of patients thought to have heart failure, but not when compared to the number of cases with LV systolic dysfunction. The present study was made...
before β-blocker and spironolactone were recommended drug regimes.

Mortality

The similar mortality of GP-HF and non-HF patients was also seen in a recent GP based study from Copenhagen. In that study both groups had a surplus mortality as compared with matched control subjects from Copenhagen. The overall mortality in the Copenhagen study was considerably larger than in the present study. This is likely to be caused by the present study’s selection of volunteer participants after exclusion of the most elderly and fragile subjects, while patients studied in Copenhagen were unselected and older.

Methodological issues/limitations

Selection bias from the selection procedures cannot be entirely avoided. However, a fair representation of primary care physicians was intended by random inclusion of at least 15 different GPs. This strategy should account for the differences in the way primary care physicians would diagnose, document and treat patients with suspected heart failure.

The findings of the present study are limited to volunteer patients in the community. The high number of exclusions and withdrawals may have led to underestimation of the prevalence as well as morbidity and mortality. Other studies also frequently experience an examination rate of 50% of the target population, while home-based echocardiography may increase the attendance rate to about 80%.

Patients were identified through a computerised search of relevant drugs. The same screening strategy would be relevant today, perhaps with addition of spironolactone. Adding β-blockers to the search would not increase sensitivity of screening but only include more false negatives as β-blockers are widely used in hypertension and ischaemic heart disease. We had foreseen to include a large group of patients receiving cardiovascular drugs without subjective or objective signs of heart failure. They were included in the analysis as a relevant reference group as they are comparable to patients studied in the HOPE trial where the effect of ramipril was assessed in patients at high risk.

Perspective

The prevalence of patients thought to have heart failure in the community is quite high, but patients constitute a very different group from the heart failure patients treated in hospitals. This means that epidemiological data from clinical trials cannot be automatically extrapolated to patients with suspected heart failure in the community. Symptomatic heart failure leading to hospitalisation is strongly associated with increased cardiac dysfunction and mortality. The non-hospitalised patients are often female, they are often insufficiently diagnosed and treated, and at least half of them will have some cardiac dysfunction upon cardiac examination. Objective cardiac testing is needed in every patient with suspected heart failure to guide the physician regarding the underlying pathology, treatment and prognosis. Using natriuretic peptides in the workup of diagnoses is helpful in untreated patients but their role still remains to be clarified in patients receiving cardiovascular treatment as in the present case.

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