

The Use of ACE Inhibitors, β -Blockers, and Warfarin in Congestive Heart Failure: A Community Hospital Study

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ABSTRACT

Background: Canadian, European, and US guidelines describe the benefits of angiotensin-converting enzyme (ACE) inhibitors, β -blockers, and warfarin (for atrial fibrillation) in the treatment of congestive heart failure. However, few studies have examined the prescribing of these drugs and the dosages used for this condition in the community hospital setting.

Objectives: To evaluate the use of ACE inhibitors, β -blockers, and warfarin for inpatients with congestive heart failure in a community hospital (the primary objective) and to identify any significant differences in prescribing practices between family physicians and general internists (the secondary objective).

Methods: Charts of patients with a primary or secondary diagnosis of congestive heart failure during the period April 2002 to February 2003 were identified. The charts were reviewed against the quality indicators of the Canadian Cardiovascular Outcomes Research Team (CCORT), including exclusion and inclusion criteria for congestive heart failure and exclusion criteria for use of ACE inhibitors, β -blockers, and warfarin. The total daily doses of ACE inhibitors and β -blockers were compared against those recommended in the European Society of Cardiology (ESC) guidelines.

Results: A total of 93 patients (49% male) were studied. The mean age (\pm standard deviation) was 78.8 ± 9.5 years. The percentage of eligible patients with prescriptions for an ACE inhibitor (94%), β -blocker (64%), or warfarin for atrial fibrillation (86%) was similar between the 26 patients treated by a family physician and the 67 patients treated by a general internist. Among the patients for whom ACE inhibitors would have been beneficial, 47% of those in the family physician group and 66% of those in the general internist group received the recommended daily dose of this type of therapy ($p = 0.18$). No patients in the family physician group and 4 patients (19%) in the general internist group received the recommended daily dose of β -blockers ($p = 0.18$). There was a trend for the prescribed dose of ramipril and metoprolol to be closer to the ESC guidelines in the general internist group than the family physician group ($p = 0.16$ and $p = 0.20$, respectively).

Conclusions: Physicians in this study achieved a relatively high degree of adherence to the guidelines in drug use for patients with congestive heart failure. These findings suggest that a close partnership between family physicians and general internists in

RÉSUMÉ

Historique : Les lignes directrices canadiennes, européennes et américaines décrivent les avantages des inhibiteurs de l'enzyme de conversion de l'angiotensine (ECA), des bêta-bloquants et de la warfarine (pour la fibrillation auriculaire) dans le traitement de l'insuffisance cardiaque congestive. Cependant, peu d'études ont examiné la prescription et les doses de ces médicaments dans le traitement de cette affection au sein d'hôpitaux communautaires.

Objectifs : Évaluer l'utilisation des inhibiteurs de l'ECA, des bêta-bloquants et de la warfarine dans le traitement des patients hospitalisés pour une insuffisance cardiaque congestive dans un hôpital communautaire (objectif primaire) et cerner toute différence significative dans les habitudes de prescription entre les médecins de famille et les internistes généralistes (objectif secondaire).

Méthodes : Les dossiers médicaux des patients qui ont reçu un diagnostic primaire ou secondaire d'insuffisance cardiaque congestive entre avril 2002 et février 2003 ont été sélectionnés. Ils ont été examinés à la lumière des indicateurs de qualité de la Canadian Cardiovascular Outcomes Research Team (CCORT), dont les critères d'inclusion et d'exclusion d'insuffisance cardiaque congestive ainsi que les critères d'exclusion de l'emploi des inhibiteurs de l'ECA, des bêta-bloquants et de la warfarine. Les doses journalières totales d'inhibiteurs de l'ECA et de bêta-bloquants prescrites ont été comparées à celles recommandées dans les lignes directrices de la Société européenne de cardiologie (SEC).

Résultats : Au total, 93 patients (49 % des hommes) ont fait l'objet de l'étude. Leur âge moyen (\pm l'écart type) était de $78,8 \pm 9,5$ ans. Le pourcentage de patients admissibles ayant reçu une prescription d'inhibiteur de l'ECA (93 % de l'échantillon total), de bêta-bloquant (64 % de l'échantillon total) ou de warfarine pour la fibrillation auriculaire (86 % de l'échantillon total) était semblable chez les 26 patients traités par un médecin de famille (groupe MF) et chez les 67 autres traités par un interniste généraliste (groupe IG). Parmi les patients qui auraient pu bénéficier d'un inhibiteur de l'ECA, 47 % de ceux du groupe MF et 66 % de ceux du groupe IG ont reçu la dose journalière recommandée pour ce type de traitement ($p = 0,18$). Aucun patient du groupe MF n'a reçu la dose journalière recommandée de bêta-bloquant et 4 (19 %) du groupe IG l'ont reçue ($p = 0,18$). On a observé que les doses de ramipril et de métoprolol prescrites avaient tendance à être plus près de celles recom-

a small community hospital may improve prescribing for patients with this condition. Additional studies examining therapy for patients with congestive heart failure from other institutions or physicians' offices are required to confirm the findings of this retrospective study.

Key words: community hospital, congestive heart failure, general internists, family physicians

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INTRODUCTION

Congestive heart failure, usually characterized by evidence of left ventricular systolic dysfunction, is associated with substantial morbidity and mortality. It is a common clinical end-stage condition for several cardiovascular diseases, including coronary artery disease, hypertension, cardiomyopathy, and valvular disease. The incidence of congestive heart failure rises with increasing age. There are estimated to be at least 10 million patients with congestive heart failure in countries represented by the European Society of Cardiology (ESC)¹ and about 5 million patients in the United States.²

The American College of Cardiology/American Heart Association (ACC/AHA) guidelines specifically address the underutilization of key processes of care such as use of angiotensin-converting enzyme (ACE) inhibitors for patients with decreased systolic function and the measurement of left ventricular ejection fraction.² A meta-analysis examining the use of ACE inhibitors for patients with congestive heart failure (for the period 1986 to 1996) found that only 37% of patients were taking these drugs at the time of presentation to hospital.³ Higher percentages of patients with confirmed systolic dysfunction were given a prescription for ACE inhibitors at hospital admission (53%) and at discharge (71%). Another concern is that the dosages of ACE inhibitors used in clinical practice are substantially lower than those proven to be efficacious in randomized control trials.³ The average dosages reported in a study conducted in 1995-1996 were captopril 37.7 mg/day (optimal 150 mg/day), enalapril 13.3 mg/day (optimal 20 mg/day), and lisinopril 12.7 mg/day (optimal 20 mg/day).^{3,4}

In the IMPROVEMENT survey,⁵ which studied patients with heart failure under the care of primary care physicians in 15 countries in 1999 and 2000, 60% of

mandées dans les lignes directrices de la SEC dans le groupe IG que dans le groupe MF ($p = 0,16$ et $p = 0,20$, respectivement).

Conclusions : Les médecins dans cette étude ont adhéré de façon relativement soutenue aux lignes directrices sur l'emploi de ces médicaments chez les patients atteints d'insuffisance cardiaque congestive. Ces résultats laissent croire qu'une collaboration étroite entre les médecins de famille et les internistes généralistes d'un petit hôpital communautaire pourraient améliorer les habitudes de prescription au bénéfice des patients présentant une telle affection. D'autres projets étudiant les médicaments prescrits aux patients atteints d'insuffisance cardiaque congestive au sein d'autres établissements de santé ou de cabinets de médecins sont nécessaires pour corroborer les résultats de la présente étude rétrospective.

Mots clés : hôpital communautaire, insuffisance cardiaque congestive, internistes généralistes, médecins de famille

patients were receiving an ACE inhibitor during the period of the study, but the overall doses prescribed were approximately 50% of the target doses suggested in the ESC guidelines.¹

Clinical trials have demonstrated the effectiveness of β -blockers such as metoprolol, carvedilol, and bisoprolol in the treatment of congestive heart failure.⁶⁻¹² Careful titration on initiation is recommended because these agents may produce a biphasic action, with initial worsening followed by long-term improvement.¹ To the authors' knowledge, there are no published randomized control led trials examining the dosages of β -blockers prescribed by specialists and general practitioners and no data showing that a suboptimal dosage of β -blocker would affect clinical outcome.

The high prevalence of ventricular and atrial arrhythmias with heart failure is well established, and an increase in congestion and deterioration of ventricular function would lead to worsening of arrhythmias. Although warfarin is not a direct treatment for congestive heart failure, its prescription at the time of discharge for atrial fibrillation in patients with congestive heart failure is one of the important considerations that may improve outcomes.¹³

This study evaluated the use of ACE inhibitors,¹⁴⁻¹⁹ β -blockers,⁶⁻¹² and warfarin²⁰⁻²² in a community hospital, relative to the recommendations of the Canadian Cardiovascular Outcomes Research Team (CCORT)/Canadian Cardiovascular Society (CCS).¹³ The CCORT/CCS has developed a series of quality indicators, with the primary objective of measuring and improving the outcomes of cardiovascular care including myocardial infarction, congestive heart failure, and cardiac procedures in Canada. The quality indicators for congestive heart failure care are intended to reflect the standard of care in Canada and to be concordant with the CCS guidelines for this condition.²³



Prescribing patterns for patients with congestive heart failure differ between cardiologists and family/general practitioners.³ A 2003 study showed that cardiologists adhere more closely to guidelines than primary care physicians in the treatment of new-onset heart failure.²⁴ The studies listed in both of these papers addressed the differences between cardiologists and other physicians (family physicians and general internists), but did not examine differences between family physicians and general internists.

The goals of the study reported here were twofold: first, to compare the use of drugs for congestive heart failure in the study hospital (including the class of drugs and the dosage regimen) with the results of previous studies and current recommendations, and second, to identify if there were significant differences in prescribing practices for patient populations seen by family physicians and general internists in this hospital setting.

METHODS

The Medical Advisory Committee of the study hospital (a 145-bed community hospital) approved the audit project "Current Drug Therapy in Congestive Heart Failure", conducted in 2002, of which this study is a part. This audit consisted of a chart review for inpatients in the community hospital during the period April 2002 to February 2003. Charts were selected for patients with a primary or secondary diagnosis of congestive heart failure and either a family physician or a general internist as the most responsible physician. Canadian quality indicators for congestive heart failure care¹³ were used as the criteria for identifying patients with this condition, and pharmacological indicators were used to identify the relevant drugs. Although ejection fraction or left ventricular dysfunction was part of the eligibility criteria, these factors were not used in this study because, at the time of the study, echocardiography was not performed routinely in this hospital for patients with congestive heart failure. The clinical judgement of the physicians was used as a standard to identify patients with congestive heart failure. Included in the study were any patients 20 to 105 years of age with a documented primary or secondary diagnosis of congestive heart failure. Patients were excluded if they had been admitted to the palliative, chronic/rehabilitation, surgical, maternal/child, or psychiatric unit; had been transferred from another facility; or had been previously admitted within the past 6 months. The specific eligibility and exclusion criteria for the use of ACE inhibitors, β -blockers, and warfarin were those outlined by the CCORT/CCS.¹³ For the purposes of this study, the maximums of the respective dosing ranges, as described in the ESC guidelines,¹ were

used as the recommended dosages of ACE inhibitors and β -blockers.

The following data were collected from the patients' charts: demographic characteristics such as age and sex; clinical information such as systolic and diastolic blood pressure, heart rate, renal function, serum potassium level, and international normalized ratio (INR); and drug names for each class and their daily doses. The number of patients with echocardiography records was also collected.

Statistical Analysis

This audit was designed to evaluate the degree to which the prescribing of family physicians and general internists complied with the CCORT recommendations¹³ and the ESC guidelines¹ and to identify differences in prescribing patterns between the 2 physician groups. SPSS for Windows (version 10.0; SPSS Inc, Chicago, Illinois) was used for descriptive and inferential (χ^2 test) statistics. Statistical significance was set at $p < 0.05$ for 2-tailed testing.

RESULTS

Demographic Characteristics

Ninety-three patients with a primary or secondary diagnosis of congestive heart failure between April 2002 and February 2003 were identified, 26 with a family physician as the most responsible physician and 67 with a general internist. The 2 physician groups were similar with respect to age and sex of the patients treated (Table 1). Very few patients were younger than 60 years of age, and most were older than 75 years. At the time of discharge, systolic and diastolic blood pressures, heart rate, serum creatinine, potassium level, and INR were similar between the 2 groups (Table 2).

Computer records indicated that 13 (50%) of the 26 patients in the family physician group and 47 (70%) of those in the general internist group underwent echocardiography ($p = 0.068$).

Prescribing Patterns

In total, 62 (67%) of the patients met the CCORT criteria¹³ of no allergy to ACE inhibitors and no contraindications and had not been documented for "nonuse" by the physician and were therefore identified as being able to benefit from ACE inhibitor use. Of these, 19 were cared for by a family physician and 43 by a general internist. An ACE inhibitor had been prescribed for 17 (89%) of the patients in the family physician group and 41 (95%) of those in the general internist group ($p = 0.38$).

In total, 67 (72%) of the patients met the CCORT criteria¹³ of no allergy to β -blockers and no contraindi-



Table 1. Patient Characteristics (n = 93)

| Variable | No. (%) of Patients | | |
|--------------------|------------------------------|------------------------------|----------------------|
| | Under Care of FP (n = 26) | Under Care of GI (n = 67) | Combined (n = 93) |
| Age (years) | | | |
| < 60 | 0 (0) | 3 (4) | 3 (3) |
| 60–75 | 7 (27) | 23 (34) | 30 (32) |
| > 75 | 19 (73) | 41 (61) | 60 (65) |
| Sex | | | |
| Male | 13 (50) | 33 (49) | 46 (49) |
| Female | 13 (50) | 34 (51) | 47 (51) |

FP = family physician, GI = general internist.

Table 2. Univariate Distribution for Vital Signs and Laboratory Values at Discharge

| Variable | Mean (SD) | | |
|----------------------------------|------------------|------------------|--------------|
| | Under Care of FP | Under Care of GI | Combined |
| Age | 80.7 (7.6) | 78.0 (10.0) | 78.8 (9.5) |
| Systolic blood pressure (mm Hg) | 122 (22.0) | 121 (24) | 122 (23) |
| Diastolic blood pressure (mm Hg) | 65 (9) | 65 (12) | 65 (11) |
| Heart rate (beats/min) | 68 (10) | 75 (12) | 73 (12) |
| Serum creatinine (µmol/L) | 124.5 (38.7) | 128.2 (75.8) | 124.6 (68.9) |
| Potassium level (mmol/L) | 4.1 (0.5) | 4.3 (0.5) | 4.2 (0.5) |
| INR | 2.3 (0.8) | 2.1 (0.6) | 2.2 (0.6) |

SD = standard deviation, FP = family physician, GI = general internist, INR = international normalized ratio.

cations such as conduction system disease, hypotension, asthma, or severe obstructive lung disease and had not been documented for “nonuse” by the physician and were therefore identified as being able to benefit from β -blocker use. Of these, 22 were cared for by a family physician and 45 by a general internist. A β -blocker was prescribed for 15 (68%) of the patients in the family physician group and 28 (62%) of those in the general internist group ($p = 0.63$). Four (27%) of the 15 patients in the family physician group and 6 (21%) of the 28 patients in the general internist group were receiving atenolol. Three patients in the family physician group and 1 patient in the general internist group were receiving other β -blockers.

A total of 37 (40%) of the patients had atrial fibrillation, met the CCORT criteria¹³ of no contraindications to warfarin, such as documented bleeding episodes and liver, and had not been documented for “nonuse” by the physician and were therefore identified as being able to benefit from warfarin use. Of these, 12 were cared for by a family physician and 25 by a general internist. Warfarin was prescribed for 11 (92%) of the patients in the family physician group and 21 (84%) of those in the general internist group ($p = 0.52$).

Prescribed Dosages

Among the patients who were receiving ACE inhibitors, 8 (47%) of the 17 in the family physician group and 27 (66%) of the 41 in the general internist group had received the recommended daily dose ($p = 0.18$). Among the patients who were receiving metoprolol or carvedilol, none of the 8 patients in the family physician group and only 4 (19%) of the 21 in the general internist group had received the recommended daily dose ($p = 0.18$). The dosages of both ACE inhibitors and β -blockers tended to be higher for patients in the general internist group than those in the family physician group. The dosages of the 2 most common ACE inhibitors prescribed for patients during the audit period, ramipril and enalapril, were analyzed. The mean daily doses for ramipril were 7.9 mg in the family physician group and 8.5 mg in the general internist group; those for enalapril were 16.6 mg in the family physician group and 17.7 mg in the general internist group. Two (29%) of 7 patients in the family physician group and 13 (59%) of 22 patients in the general internist group received ramipril at the recommended dose (10 mg/day). There was a trend



($p = 0.16$) for the general internists to prescribe higher doses of ramipril than the family physicians. Four (50%) of 8 patients in the family physician group and 8 (62%) of 13 patients in the general internist group received enalapril at the recommended dose (20 mg/day) ($p = 0.60$). The mean daily doses for metoprolol were 54.2 mg in the family physician group and 105.8 mg in the general internist group, whereas for carvedilol the mean daily doses were 12.5 mg in the family physician group and 18.0 mg in the general internist group. Altogether, 4 (14%) of 29 patients received the recommended dose and 10 (34%) received half of the recommended dose of metoprolol or carvedilol. In the general internist group, 3 (23%) of 13 patients received metoprolol at the recommended daily dose (150 mg/day) and 1 (13%) of 8 patients received carvedilol at the recommended dose (50 mg/day). None of the patients in the family physician group received the recommended dose of metoprolol or carvedilol. There were no significant differences between the family physician and general internist groups in terms of the frequency of patients receiving the recommended daily dose of metoprolol ($p = 0.20$) or carvedilol ($p = 0.60$). One (17%) of 6 patients in the family physician group and 7 (54%) of 13 patients in the general internist group received metoprolol at half of the recommended daily dose (75 mg/day) ($p = 0.13$). Neither of the 2 patients in the family physician group and 2 (25%) of the 8 patients in the general internist group received carvedilol at half of the recommended daily dose (25 mg/day) ($p = 0.43$). Dosages prescribed for patients receiving atenolol and other β -blockers were not analyzed because they were not covered in the guidelines.

DISCUSSION

In the authors' facility, ACE inhibitors, β -blockers, and warfarin were prescribed for 94%, 64%, and 86% of patients, respectively, who were identified as potentially benefiting from their use. While not optimal, these results indicate substantial concordance with the CCORT and ESC guidelines.

According to the CCORT criteria, patients eligible for ACE inhibitors and β -blockers are those with moderate to severe ventricular dysfunction or an ejection fraction below 40%. The population of patients studied was limited by the proportion who had retrievable echocardiography records; for many patients, echocardiography had not been ordered during the treatment process or had been ordered outside the hospital and the records were not retrievable because of privacy restrictions. This study included patients with all types of congestive heart

failure because it was not routine practice to order echocardiography for patients with congestive heart failure at the time of the study.

The vital signs and laboratory values at time of discharge were similar for patients in the family physician and general internist groups. Some of the patients in the general internist group might have had newly diagnosed congestive heart failure, in which case physicians would have needed more time to titrate the drug therapy. The patients in the family physician group were slightly older than those in the general internist group and might therefore have been at a later stage of the disease, needing admission to hospital without further intervention by a general internist.

The absolute benefit of ACE inhibitors, an improvement in survival, is greatest among patients with the most severe heart failure. According to the ESC guidelines, however, ACE inhibitors improve the functional status of patients with heart failure, prevent further deterioration of left ventricular function, and attenuate further cardiac dilatation.¹ In this study, a high proportion of patients in both groups (at least 90%) were given an ACE inhibitor, consistent with the CCORT target level for congestive heart failure process indicators in patients with no contraindication to an intervention.¹³ This result is better than the 53% of patients receiving ACE inhibitors at discharge among unselected patients with heart failure and the 71% receiving ACE inhibitors at discharge among patients with known systolic dysfunction reported in a recent meta-analysis³ and the 60% of patients in the IMPROVEMENT study.⁵ For more than 50% of patients, the prescribed daily dose of ACE inhibitors was that recommended in the current guidelines. The discharge data on systolic blood pressure, diastolic blood pressure, and serum creatinine level may indicate that higher doses of ACE inhibitors could have been used. However, the retrospective design of the study did not permit determination of whether the doses were optimal for a population with an average age of 75 years.¹ There was a trend for general internists to prescribe higher dosages of ACE inhibitors ($p = 0.18$) and β -blockers ($p = 0.18$) than the family physicians. The lack of statistical significance could be due to the small sample size. There was no statistically significant difference between groups in dosing of ramipril ($p = 0.16$) or enalapril ($p = 0.60$), but there was a trend toward higher dosing of ramipril by the general internists. The family physicians might have had more experience and therefore greater comfort in dosing for enalapril, the older of the 2 ACE inhibitors, than ramipril.

The percentage of patients who were receiving β -blockers (at least 62%) in this study was better than

the 34% observed in the IMPROVEMENT study⁵ and the 38% reported recently for patients with new-onset heart failure seen by cardiologists.²⁴ Administration of β -blockers was consistent with the CCORT target level for congestive heart failure process indicators in patients with no contraindication to an intervention, for whom it is recognized that β -blockers may be more appropriately started in the outpatient setting.¹³ In this study, physicians used atenolol in some cases, although it is not one of the recommended β -blockers. Some physicians may have been considering the class effect of β -blockers and prescribing them for patients with heart failure, but there are no data to confirm this assumption. Patients receiving atenolol were considered to be taking a β -blocker, but dosages were not analyzed because this drug is not covered in the guidelines. The percentage of patients receiving the recommended dose of β -blockers was low. This may have been due to the older age of patients and the early stage of their β -blocker therapy. The golden rule of “start low and go slow” may have been another reason for relatively low dosages of β -blockers. General internists prescribed metoprolol, an older agent, at higher doses than were used for carvedilol, a newer agent. The physicians might have been more familiar with metoprolol dosing than with carvedilol dosing at the time of the study. Although there was no statistically significant difference between the family physicians and general internists in terms of patients receiving metoprolol at the recommended dose ($p = 0.20$) or half the recommended dose ($p = 0.13$), there was a trend for the general internists to prescribe higher doses.

Physicians in this study prescribed warfarin for atrial fibrillation for at least 84% of patients, which is consistent with the target level for congestive heart failure process indicators in patients with no contraindication to an intervention.¹³

Overall, there were no significant differences between the family physicians and general internists in the prescribing of ACE inhibitors, β -blockers, and warfarin. This lack of difference might have been because inpatients in the family physician group had been referred to general internists at some point before this study began. Previous reports have suggested that case management programs for patients with congestive heart failure^{3,25} and experience-sharing among physicians (including cardiologists, general internists, and family physicians) through educational outreach visits may improve adherence to guidelines.² Thus, the close partnership between family physicians and specialists in this small community may have led to the similarities in prescribing patterns in the 2 groups. Studies from other community hospitals with different practice models

might find differences in prescribing patterns between family physicians and general internists.

Several limitations of this study warrant mention. The study had limited power because of the small number of patients and limited generalizability because it was performed in a single rural community hospital. The study would be more representative if other hospitals or physicians' offices were involved. Because the study was retrospective, some of the data used for excluding patients, such as drug intolerance and previous medical history, were retrieved from discharge summaries; any missing information could lead to inaccurate results. While the possibility of room for improvement in the dosing of ACE inhibitors and β -blockers could not be answered, disease management programs such as a clinic for patients with congestive heart failure might provide a standardized approach to improving care in the elderly population.

CONCLUSIONS

Physicians in this study achieved a relatively high degree of adherence to the guidelines in drug use for patients with congestive heart failure, which suggests that a close partnership between family physicians and general internists in a small community hospital may improve overall prescribing. Although there may be room for improvement in the dosing of β -blockers for patients with congestive heart failure in community hospitals, it would be difficult to reach this conclusion from a retrospective audit. Additional studies with patients from other institutions or physicians' offices are required to confirm the findings of this study.

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