Evaluation of a potential correlation between the time to planned outpatient clinic follow-up and mortality and re-admission of patients with CHF

Johannes Schlonodorff

A. Study Purpose and Rationale

Congestive heart failure (CHF) is a major burden on the health care system of the United States. It is estimated that 5 million people in the US have CHF, with half-a-million people receiving a new diagnosis of CHF each year(1). The number of admissions due to CHF rose dramatically from 1985 to 1995, from 577,000 to 871,000 when CHF was listed as the primary admission diagnosis, and from 1.7 to 2.6 million hospitalizations where CHF was listed as one of the diagnoses(2). The elderly are at particular risk. Seniors over the age of 65 account for more than three-quarters of all CHF hospitalizations(2). Among Medicare patients, CHF is the leading cause of hospital admissions(3). Furthermore, with the predicted aging of the US population, the number of CHF cases is estimated to double over the next 40 years(4).

CHF patients, like many patients with chronic diseases, are at increased risk for recurrent hospitalizations. The frequency of rehospitalization varies depending on the specific population examined; however, the numbers are uniformly high(2, 5-19). A large survey from the Netherlands estimated 18% of CHF patients are rehospitalized within 2 years of the time of their first admission for CHF(5). In the United States, published readmission rates range from 21.3% over an average 6.9 month time period(6) to 47% during the first 90 days post-discharge(8). It is not surprising that readmissions account for a significant portion of the costs of treating CHF.

Decreasing the rate of hospitalization of CHF patients is an important goal both for individual physicians and for the public health community. Several retrospective and observational studies have attempted to identify populations at high risk for readmission(6,7,10,11,20). However, while some stratification of patients is possible at the time of discharge, no subset of the population can be regarded as being a "low-risk" group. Strikingly, though, several investigators have estimated that between a third to a half of all readmissions are possibly or probably preventable. Not surprisingly, non-compliance with a medical regimen, and inadequate discharge planning and follow-up represent most of these cases(8,9).

Based on these findings, several observational and prospective, randomized trials have examined the efficacy of multidisciplinary interventions on the rates of readmission and mortality in CHF patients(12-18,21). The intervention was compared to continued or previous care by the patient's primary care physician. These studies involved predominantly nurse-based initiatives beginning during the index hospitalization and continuing through discharge, with an emphasis of ensuring patient's understanding of their disease and medications, compliance with their medical regimen, frequent contact between the patient and their care providers, and early detection of symptoms of CHF exacerbations. With the exception of the VA study(13), which reported an increased rate of hospitalization and totals days spent in hospital, this type of approach has been reported to be successful in reducing hospitalizations and costs. A meta-analysis of randomized trials of disease management programs found improvements in rates of hospitalizations and cost savings, though no significant reduction in all-cause mortality(22).

Unfortunately, use of a multidisciplinary intervention requires the investment of significant resources and therefore is not easily instituted at a given institution. It is not possible from the available studies to determine whether it is one particular element of the multidisciplinary approach, or a combination of all of them, that accounts for their success. Akosah et al.(15) found that the patients in their study arm had a significantly shorter time from discharge to their first outpatient visit compared to controls. Furthermore, while other studies do not document the time from discharge to outpatient follow-up in the control groups, all mandated "prompt" follow-up in the study arm, usually within 2 weeks of

discharge(16,17,23). It is possible that rapid follow-up with a physician accounts for a significant proportion of the beneficial effect of a multidisciplinary approach.

Here, we propose a retrospective analysis to investigate the hypothesis that prompt follow-up with a primary care physician after discharge is associated with a lower readmission rate and mortality for patients with CHF in the 6 months following discharge. If true, providing rapid post-discharge follow-up would be a relatively easy service to provide to CHF patients and its utility could be further tested in a prospective randomized study.

B. Study Design and Statistical Analysis

The study is a retrospective cohort study involving patients with CHF discharged from the CPMC hospital system with scheduled follow-up at one of the internal medicine resident clinics. See specific inclusion and exclusion criteria under section G below. The subjects will be divided based on the time period between their hospital discharge and their first scheduled appointment at the clinic. The rapid follow-up group will include patients with scheduled follow-up within 14 days of discharge. Although somewhat arbitrary, this time period is based on similar goals in studies evaluating disease management programs(16,17,23) and on an assessment of what would be feasible to implement as a standard of care in the future. This group will be compared with patients whose scheduled appointment is more than 3 weeks from the date of discharge, termed the delayed follow-up group. Patients with scheduled follow-up between 2 and 3 weeks post-discharge will not be included in the primary analysis to provide better contrast between the two study groups.

The study period will involve the six months following a patient's index hospitalization, defined as the first admission on or after January 1, 1999, for which a CHF exacerbation or underlying CHF is felt to be a significant contributor to the admission. The primary endpoints examined in the study will include all-cause mortality and non-elective readmission to a hospital in the 6 month period following discharge. Secondary endpoints include death and readmission secondary to CHF exacerbation, emergency department visits. Other outcomes that will be assessed include total number of non-elective hospitalizations and days hospitalized in the 6 month follow-up period. We decided to look at the broader endpoint of all cause hospitalizations and mortality over cardiac morbidity and mortality. The predominant reason for this approach is that the intervention that we are examining, rapid follow-up at a general medicine clinic, should be predicted to focus on the patient's general medical care, not specifically on their CHF.

The initial cohort of potential subjects will been identified through a search of the WebCIS data warehouse to identify patients who had at least one admission to CPMC during the study period in which CHF was listed as one of the discharge diagnoses and who have Medicaid insurance. Charts from these patients will be reviewed to determine whether CHF played a significant role in their initial hospitalizations and whether the patients are eligible based on the predetermined inclusion and exclusion criteria. Once deemed eligible, further information will be culled from both the data warehouse and from patient charts. Pertinent data includes: age, gender, the time from discharge to scheduled clinic appointment, NYHA functional class, ejection fraction (if assessed within the 18 months preceding discharge by either echocardiography or nuclear imaging), co-morbidities (specifically coronary artery disease or prior myocardial infarction, DM, COPD and chronic renal insufficiency), medications on discharge, whether the patient was seen on the cardiology service or the CHF team during the index hospitalization, whether and when outpatient follow-up was scheduled at the cardiology or heart failure clinic, whether the patient was discharged with VNS services, the length of index hospitalization, the number of hospital admissions in the six months prior to the index hospitalization. In addition, information about potential endpoints (time to death or non-elective hospital admission, number of non-elective admissions and days hospitalized, emergency department visits, actual number of clinic visits) will be gathered. The SPARCS (Statewide Planning and Research Cooperative System) database and National Death Registry will be searched to ensure that hospitalizations and deaths outside of the CPMC

system are captured. In addition, chart reviewers will assess whether subsequent hospitalizations or death were likely secondary to CHF.

The retrospective study will include all eligible patients whose index admission occurred between January 1, 1999 and December 31, 2001. This time period was chosen based on data availability through the WebCIS data warehouse and on power calculations to ensure an adequate population size. We estimated that the Medicaid patient population would have a similar risk of death and readmission as a general Medicare population(10) or a VA population(13), both of which have reported rates of approximately 45% over a 6 month period. We have assumed a 15 % relative reduction for the primary endpoint in the rapid follow-up group (absolute difference of 7%). This is based on relative risk reductions calculated in the meta-analysis of disease management programs in heart failure and would likely be of clinical interest. Assuming equal numbers of patients in the rapid and delayed follow-up groups, a power level of 0.8 and an acceptable alpha error of 0.05, the two study populations would require 805 subjects each.

Based on initial searches using the CPMC data warehouse, there were 7128 patients with at least one admission with CHF as a listed discharge diagnosis, based on the ICD9 code 428.0, between 1/1/1999 and 12/31/2001. Assuming approximately half of these patients are Medicaid patients, that at least three-quarters had at least one hospital admission for a CHF exacerbation, and that two-thirds of those patients had a scheduled follow-up at one of the residency clinics, this would provide a study population of approximately 1800 patients, sufficient to adequately power the study.

To ensure that our study sample estimates are accurate and that the study will be satisfactorily powered, we plan to compare our estimates of patient eligibility with actual patient eligibility after data has been collected from the first 10% of possible subjects. At this point, the decision will be made whether to expand the study period (the WebCIS data warehouse contains complete data reaching back to 1997) to ensure adequate power.

Analysis of the data is planned to include the following: 1. χ^2 analysis for association between rapid versus delayed follow-up and the above mentioned primary and secondary endpoints. 2. χ^2 analysis to determine associations for categorical data (e.g. sex, NYHA functional CHF class, normal versus depressed EF, presence of CAD, DM, COPD or chronic renal insufficiency, and prescription of various CHF medications such as beta-blockers, ACE inhibitors, loop diuretics, spironolactone and digitalis at discharge) and death or rehospitalization. 3. Student unpaired t-test analysis to determine associations for interval data (including age, length of index hospitalization, number of prior hospitalizations, time to first scheduled clinic appointment) and the primary endpoints. 4. The effects of covariates will be determined using Kaplan-Meier curves. Significant bivariate correlates will be utilized in a Cox proportional hazards regression model. This analysis will be used no only comparing the rapid and delayed follow-up groups, but also comparing quartiles of patients divided based on time to planned outpatient follow-up.

C. Study Procedure

N/A.

D. Study Drugs

N/A

E. Medical Devices

N/A

F. Study Questionnaires

N/A

G. Study Subjects

As mentioned briefly in section B above, study subjects will include patients with a CPMC hospital admission for CHF during the study period of 1/1/1999 to 12/31/2001 and a scheduled follow-up at one of the general medicine resident clinics.

Exclusion criteria include age less than 30, pregnancy at the time of index hospitalization, consideration for heart transplantation, death during the index hospitalization, discharge to a skilled nursing facility or rehabilitation facility, diagnosis of a terminal cancer at the time of index hospitalization, ESRD requiring dialysis, and participation in a clinical trial during the study period.

Pregnant patients will be excluded from this study as the etiology, treatment and follow-up for their CHF may be significantly different from the remainder of the study population. Similarly, patients under the age of 30 are more likely to have a congenital cause of their underlying CHF. Neither of these two groups are expected to constitute a significant portion of the potential study population.

H. Recruitment of Subjects

Initial evaluation of the WebCIS data warehouse has identified over 7000 patients hospitalized at CPMC with a diagnosis of CHF based on ICD coding during the potential study period. Upon IRB approval, this subset of patients will be further searched for those over the age of 30 with Medicaid insurance to isolate those patients eligible for follow-up at the resident clinics. Eligibility will further be assessed through manual chart review.

I. Confidentiality of Study Data

All subjects included in the study will be given a unique identification code, which will be the sole patient identifier (with the exception of age and gender). All clinical data will be stored under this identification code. A master code will be kept, but only accessible upon further IRB approval.

J. Potential Conflict of Interest

K. Location of the Study

L. Potential Risks

None to the study subjects.

M. Potential Benefits

No potential benefits for the study subjects. Evidence that rapid outpatient follow-up correlates with decreased mortality and readmission rates in CHF patients would provide motivation to pursue randomized studies to further address this issue. Given the burden of CHF in the US population, even modest improvements in mortality and readmission rates would be of significant benefit both from an individual and public health perspective.

N. Alternative Therapies

N/A

O. Compensation to Subjects

None.

P. Costs to Subjects

None.

Q. Minors as Research Subjects

No minors will be included in the research study.

R. Radiation or Radioactive Substances

N/A

S. References:

1. Hunt SA, Baker DW, Chin MH, et al. ACC/AHA guidelines for the evaluation and management of chronic heart failure in the adult: executive summary. A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to revise the 1995 Guidelines for the Evaluation and Management of Heart Failure). J Am Coll Cardiol 2001; 38:2101-2113.
2. Haldeman GA, Croft JB, Giles WH, Rashidee A. Hospitalization of patients with heart failure: National Hospital Discharge Survey, 1985 to 1995. Am Heart J 1999; 137:352-360.
3. Hennen J, Krumholz HM, Radford MJ. Twenty most frequent DRG groups among Medicare inpatients age 65 or older in Connecticut hospitals, fiscal years 1991, 1992, and 1993. Conn Med 1995; 59:11-15.
4. Rich MW. Epidemiology, pathophysiology, and etiology of congestive heart failure in older adults. J Am Geriatr Soc 1997; 45:968-974.
5. Reitsma JB, Mosterd A, de Craen AJ, et al. Increase in hospital admission rates for heart failure in The Netherlands, 1980-1993. Heart 1996; 76:388-392.
6. Philbin EF, DiSalvo TG. Prediction of hospital readmission for heart failure: development of a simple risk score based on administrative data. J Am Coll Cardiol 1999; 33:1560-1566.
7. Cowie MR, Fox KF, Wood DA, et al. Hospitalization of patients with heart failure: a population-based study. Eur Heart J 2002; 23:877-885.
8. Vinson JM, Rich MW, Sperry JC, Shah AS, McNamara T. Early readmission of elderly patients with congestive heart failure. J Am Geriatr Soc 1990; 38:1290-1295.
9. Michalsen A, Konig G, Thimme W. Preventable causative factors leading to hospital admission with decompensated heart failure. Heart 1998; 80:437-441.
10. Krumholz HM, Parent EM, Tu N, et al. Readmission after hospitalization for congestive heart failure among Medicare beneficiaries. Arch Intern Med 1997; 157:99-104.
11. Chin MH, Goldman L. Correlates of early hospital readmission or death in patients with congestive heart failure. Am J Cardiol 1997; 79:1640-1644.
12. Fonarow GC, Stevenson LW, Walden JA, et al. Impact of a comprehensive heart failure management program on hospital readmission and functional status of patients with advanced heart failure. J Am Coll Cardiol 1997; 30:725-732.
13. Weinberger M, Oddone EZ, Henderson WG. Does increased access to primary care reduce hospital readmissions? Veterans Affairs Cooperative Study Group on Primary Care and Hospital Readmission. N Engl J Med 1996; 334:1441-1447.

14. Rich MW, Beckham V, Wittenberg C, Leven CL, Freedland KE, Carney RM. A multidisciplinary intervention to prevent the readmission of elderly patients with congestive heart failure. N Engl J Med 1995; 333:1190-1195.
15. Akosah KO, Schaper AM, Havlik P, Barnhart S, Devine S. Improving care for patients with chronic heart failure in the community: the importance of a disease management program. Chest 2002; 122:906-912.
16. Stewart S, Horowitz JD. Home-based intervention in congestive heart failure: long-term implications on readmission and survival. Circulation 2002; 105:2861-2866.
17. Doughty RN, Wright SP, Pearl A, et al. Randomized, controlled trial of integrated heart failure management: The Auckland Heart Failure Management Study. Eur Heart J 2002; 23:139-146.
18. Kasper EK, Gerstenblith G, Hefter G, et al. A randomized trial of the efficacy of multidisciplinary care in heart failure outpatients at high risk of hospital readmission. J Am Coll Cardiol 2002; 39:471-480.
19. Smith GL, Masoudi FA, Vaccarino V, Radford MJ, Krumholz HM. Outcomes in heart failure patients with preserved ejection fraction: mortality, readmission, and functional decline. J Am Coll Cardiol 2003; 41:1510-1518.
20. Opasich C, Rapezzi C, Lucci D, et al. Precipitating factors and decision-making processes of short-term worsening heart failure despite "optimal" treatment (from the IN-CHF Registry). Am J Cardiol 2001; 88:382-387.
21. Capomolla S, Febo O, Ceresa M, et al. Cost/utility ratio in chronic heart failure: comparison between heart failure management program delivered by day-hospital and usual care. J Am Coll Cardiol 2002; 40:1259-1266.
22. McAlister FA, Lawson FM, Teo KK, Armstrong PW. A systematic review of randomized trials of disease management programs in heart failure. Am J Med 2001; 110:378-384
23. ++Rich MW, Vinson JM, Sperry JC, et al. Prevention of readmission in elderly patients with congestive heart failure: results of a prospective, randomized pilot study. J Gen Intern Med 1993; 8:585-590.