Predictors Of Death Or Readmission In African-Americans And Hispanics Hospitalized For Congestive Heart Failure In An Inner City Hospital

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Abstract

Paucity of data exists on predictors of death and/or readmission in African-Americans and Hispanics hospitalized for congestive heart failure (CHF). Retrospective review of 189 consecutive patients discharged with CHF diagnosis (ICD-9-CM-428.0) was conducted. Patients were divided into two groups: with and without death and/or readmission. Clinical and laboratory variables were compared between the two groups. Overall demographics were: mean age 65 yrs, African-Americans 55%, Hispanics 40%, females 55%, hypertension 86%, diabetes 51%, and coronary artery disease 35%. There were 37 (20%) readmissions and a total of 8 (4%) deaths during a median follow-up of 185 days. On univariate analysis only following were significant predictors of death and/or readmission: CHF history, jugular venous distension, pleural effusion, serum creatinine on admission ≥ 2.5 mg/dl, lower total cholesterol, lower LDL, atrial fibrillation, any – bundle branch block (BBB) and echocardiographic parameters as right atrial enlargement, tricuspid regurgitation and pulmonary hypertension. On multivariate analysis the significant predictors were: pulmonary hypertension, any BBB and pleural effusion. However the following did not predict death and/or readmission: age, sex, body mass index, rales, S3-gallop, heart rate, blood pressure and pedal edema, left bundle branch block, left ventricular hypertrophy, ejection fraction, left atrial or ventricular dilatation; or discharge medications.

Conclusion: The predictors of death and/or readmission among African-American and Hispanics hospitalized for CHF were: pulmonary hypertension, any BBB and pleural effusion on chest X-ray. These are variables, which are easily available on routine basic investigations that can help in the assessment of death and/or readmission in CHF patients.

INTRODUCTION

Congestive heart failure (CHF) is both a major and an escalating health problem in the United States [1,2] associated with high rates of death [1,3, 4] functional decline [5, 6] and hospital admissions [4]. Important prognostic factors have been identified among clinical trial enrollees. However, factors that predict mortality in the community setting may differ [7]. Although CHF is a common and serious condition treated by generalists and specialist physicians, few methods exist to help quantitatively estimate prognosis. As a result clinicians must rely on published mortality rates from clinical trials or other studies, in which patients populations may differ from those encountered in clinical practice. Nationally, African Americans have higher mortality [8,9] and hospitalizations rates [10, 11] compared with other racial/ethnic groups and there is limited data among Hispanics regarding mortality and rehospitalizations.

The reason for the higher rates of death and hospital admissions resulting from heart failure in African Americans is uncertain. These statistics might reflect a higher incidence of heart failure among African Americans. Alternatively, these data might reflect a poorer course of heart failure among African Americans or inadequate access to health care. To date there is paucity of data on predictors of death and/or readmission in African-Americans and Hispanics hospitalized for CHF. This study was designed to determine if there were any predictors of death and/or readmission in African-Americans and Hispanics hospitalized for CHF.

METHODS

The study design was a retrospective chart review. The study population consisted of 189 consecutive patients discharged with a diagnosis of CHF (ICD-9-CM-428.0) from an inner city hospital in the Bronx. The patients were identified from a computer database of all patients discharged between

January 1,1999, through October 31, 1999. Information was abstracted from the medical records by physicians (faculty or medical residents) using a standard data collection instrument. In an event of discrepancies, consensus was obtained between the reviewers. Abstracted items included demographic characteristics such as age, race and gender. Clinical information including date of admission and discharge, primary admission diagnosis and up to four other admission diagnoses was recorded. Detailed past medical history including hypertension (HTN), diabetes mellitus (DM), CHF, angina, coronary artery disease (CAD) previous myocardial infarction (MI), percutaneous transluminal coronary angioplasty (PTCA), and coronary artery bypass grafting (CABG), atrial fibrillation (AF), cerebrovascular accident (CVA), peripheral vascular disease (PVD), chronic obstructive pulmonary disease (COPD), other pulmonary, renal, liver and thyroid diseases and family history were recorded. Symptoms such as dyspnea, orthopnea, paroxysmal nocturnal dyspnea, number of pillows used during sleep, detailed physical examination findings including vital signs on arrival to emergency department and admission to the floor, laboratory variables on admission and at hospital discharge, EKG and echocardiographic variables, hospital course, medications on discharge were collected in detail. To determine the association between patient characteristics and outcomes, we developed a study sample in which each patient was represented only once. Independent predictors used to assess the risk of death and/or readmission included all demographic, clinical, laboratory and procedural data.

OUTCOMES

Outcome measures included combined outcome of death and/or hospital readmission primarily due to CHF during a median follow-up of 185 days, approximately 6 months (mean 168 ± 88 days). Occurrence of CHF readmission was tracked from the hospital database maintained on all hospitalizations that occur at this institution.

STATISTICAL ANALYSIS

Continuous variables are expressed as mean ±1 SD and categorical variables as percentages. The association of independent predictors with study outcomes was assessed in univariate analysis using Chi square and Student t test. A p value < 0.05 was considered statistically significant. Variables considered for inclusion in multivariate models were age, sex, left ventricular ejection fraction and other variables if they had a univariate association with the

outcome at p < 0.05. Multivariate logistic regression models were created using backward variable selection procedure. Adjusted odds ratio and 95% confidence intervals were calculated.

RESULTS

In the study period we studied 189 consecutive patients discharged with the diagnosis of CHF during the study period. Mean age of the entire group was 65 ± 14.8 years with a range of 22 to 96 years. Fifty-five percent were females. African Americans comprised 55% and Hispanics comprised 40% of the entire group with 5% belonging to other ethnicities. There were 37 (20%) readmissions and total of 8 (4%) deaths with one death after the second hospitalization during a 6-month follow-up. Patients were divided into two groups: patients with and without death and/or readmission due to CHF. All comparisons are between the two groups. The variables studied were divided into four different categories as demographics, admission variables, EKG and echocardiographic parameters and discharge medications and the comparisons between the two groups are tabulated in tables 1-4. There were no significant differences in the baseline characteristics between the two groups except for a past medical history of CHF, which was more common among patients who died and/or were readmitted. (See Table –1)

Table-5 shows the clinical factors that had significant univariate association with the occurrence of death and/or readmission. Following variables were significant predictors of death and/or readmission on univariate analysis among African-Americans and Hispanic patients hospitalized for CHF: past medical history of CHF, jugular venous distension, pleural effusion, serum creatinine on admission ≥ 2.5 mg/dl, lower total cholesterol, lower LDL, AF, any – bundle branch block, right atrial enlargement, tricuspid regurgitation and pulmonary hypertension.

Table – 6 shows the significant multivariate association of the study variables with the occurrence of death and/or readmission. The most significant predictors of early readmission and/or death included pulmonary hypertension, any bundle branch block and pleural effusion diagnosed by chest x-ray. Pulmonary hypertension entered the model first with largest Chi2 value of the 3-prognosticatic variables.

Figure 1

Table 1: Baseline Characteristics

		Patients with Readmissions and/or death (n = 44)	Patients without Readmissions and/or death (n = 145)	p value
Demographics				
	Mean Age (yrs)	67	64	0.25
	Females	52%	56%	0.67
	BMI (kg/m^2)	31±10	32±10	0.38
Ethnicity				
	African Americans	52%	55%	0.93
	Hispanics	39%	40%	0.93
Length of Stay (days) (Index hospitalization)		7.6 ± 7.7	6.9 ±7.37	0.59
Co-morbid Conditions				
	Systemic HTN	91%	84%	0.26
	DM	54%	50%	0.65
	Angina	14%	15%	0.94
	CAD	29%	37%	0.38
	Previous MI	16%	21%	0.52
	PTCA	0%	2%	0.45
	CABG	11%	9%	0.63
	CHF	76%	55%	0.01
	PVD	18%	13%	0.47
	AF	29%	20%	0.27
	CVA	8%	8%	0.91
	COPD	22%	12%	0.14
	Kidney Disease	33%	27%	0.46
	On Dialysis	4%	2%	0.59
	Liver Disease	6%	6%	0.92
	Smokers	22%	25%	0.16
	Alcohol users	85%	10%	0.09

AF- atrial fibrillation, BMI – body mass index, CABG- coronary artery bypass grafting, CAD- coronary artery disease, CHF-congestive heart failure COPD - chronic obstructive pulmonary disease, CVA- cerebrovascular accident, DM- diabetes mellitus, HTN- hypertension, MI- myocardial infarction, PVD - peripheral vascular disease, PTCA- percutaneous transluminal coronary angioplasty.

Figure 2

Table 2: Clinical and laboratory variables between the two groups

		Patients with Readmissions and/or death (N = 44)	Patients without Readmissions and/or death (N =145)	p value
Admission variables				
	Systolic BP ≥160mmHg	53%	42%	0.27
	Diastolic BP ≥110 mmHg	9%	23%	0.09
	Heart rate ≥100 bpm	31%	41%	0.29
	Dyspnea on exertion	84%	86%	0.79
	Orthopnea	65%	63%	0.83
	Paroxysmal nocturnal dyspnea	45%	50%	0.54
	JVD	64%	46%	0.03
	Rales	78%	71%	0.34
	S3 Gallop	11%	10%	0.85
	Cardiomegaly	31%	26%	0.51
	Cardiomegaly on CXR	86%	76%	0.14
	Hepatomegaly	18%	10%	0.17
	Pleural effusion (physical exam)	27%	13%	0.04
	Pleural effusion (CXR)	52%	31%	0.01
	Congestion on CXR	61%	46%	0.08
	Ankle edema	76%	70%	0.46
Laboratory				
	BUN ≥ 30 mg/dl	43%	33%	0.19
	Creatinine ≥ 2.5 mg/dl	21%	10%	0.05
	Sodium ≥120 mEq/L	100%	99%	0.57
	Mean Cholesterol mg/dl	147 ± 42	171 ± 45	0.01
	Mean LDL mg/dl	81 ± 31	97 ± 33	0.04
	Mean HDL mg/dl	42 ± 16	45 ± 15	0.44
	Albumin g/dl	3.4 ± 0.6	3.5 ± 0.6	0.21

BP – blood pressure, bpm – beats per minute, BUN – blood urea nitrogen, JVD – jugular venous distension, CXR – chest X ray.

Figure 3

Table 3: EKG and Echocardiographic variables

		Patients with Readmissions and/or death (N = 44)	Patients without Readmissions and/or death (N =145)	p value
EKG				
	LBBB	11%	11%	0.88
	Bundle branch block- any	26%	12%	0.03
	AF	30%	14%	0.02
	LVH	19%	31%	0.16
	Left atrial enlargement	24%	33%	0.28
	Ischemic Changes	45%	43%	0.85
	Old MI	26%	25%	0.90
Echocardiogram				
	EF ≤ 45%	47%	49%	0.78
	Left atrial enlargement	75%	60%	0.07
	Right atrial enlargement	38%	20%	0.02
	LVH	61%	52%	0.07
	Dilated LV	24%	29%	0.56
	Mitral regurgitation	78%	63%	0.09
	Tricuspid regurgitation	81%	58%	0.008
	Aortic regurgitation	32%	36%	0.63
	Pulmonary HTN	62%	35%	0.002
	Mean pulmonary pressure	51± 23	48 ±18	0.65

AF- atrial fibrillation, EF – ejection fraction, EKG – electrocardiogram, HTN - hypertension, LBBB – left bundle branch block, LV – left ventricle, LVH – left ventricular hypertrophy, MI- myocardial infarction.

Figure 4

Table 4 : Discharge Medications

		Patients with Readmissions and/or Death (n = 44)	Patients without Readmissions And/or death (n =145)	p value
Discharge Medications				
	Diuretics	80%	76%	0.61
	Digoxin	41%	38%	0.72
	ACE –I	64%	74%	0.19
	Beta-blockers	25%	24%	0.90
	Calcium channel blockers	23%	26%	0.70
	Nitrates	16%	13%	0.63
	Coumadin	14%	8%	0.28

ACE-I – angiotensin converting enzyme inhibitor.

Figure 5

Table 5: Univariate Correlates of Risk of Death and/or Readmission After Hospitalization for Heart Failure

	Patients with Readmissions And/or death (N = 44)	Patients without Readmissions And/or death (N =145)	p value
Past medical history of CHF	76%	55%	0.01
Jugular venous distension	64%	46%	0.03
Pleural effusion by CXR	52%	31%	0.01
Serum Creatinine ≥ 2.5 mg/dl	21%	10%	0.05
Mean Cholesterol mg/dl	147± 42	171 ± 45	0.01
Mean LDL mg/dl	81 ± 31	97 ± 33	0.04
Bundle branch block- any	26%	12%	0.03
Atrial Fibrillation	30%	14%	0.02
Tricuspid regurgitation	81%	58%	0.008
Pulmonary HTN	62%	35%	0.002
Right atrial enlargement	38%	20%	0.02

CHF – congestive heart failure, CXR – chest X-ray, LDL – low density lipoprotein, HTN – hypertension.

Figure 6

Table 6: Multivariate Correlates of Risk of Death and/or Readmission After Hospitalization for Heart Failure

Correlates	Odds Ratio (95%CI)	p - value
Pulmonary HTN	4.4 (1.6-12.3)	0.005
Bundle branch block- any	4.6 (1.4-15.8)	0.014
Pleural effusion by CXR	3.6 (1.3-10.2)	0.016

CI – confidence interval, CXR – chest X-ray, HTN – hypertension.

DISCUSSION

The 4% incidence of death and 20% incidence of readmission in our study was lower than reported earlier by Vaccarino et al who reported an 19% incidence of death on a 6 month follow up of African Americans with CHF and a 50% incidence of readmission (1994-1998 data). [12] The incidence of readmission in our study was also lower than reported by Harjai et al who reported a 26% readmission risk within 30 days after discharge (1994-95 data).[13] The lower incidence of death and readmission in our study may be partly explained by more awareness and aggressiveness in the treatment of CHF which has evolved rapidly over the years. Our study included patients from the year 1999 which revealed an overall higher use of ACE-I -74 % compared to 48% and 66% respectively in the above two studies [12,13] although the use of beta-blockers were similar. In patients with chronic CHF higher body mass index (BMI) appear to have a better prognosis.[14, 15] The mean BMI of 31 in our study population may explain a little better prognosis. In our study only readmissions primarily for CHF were analyzed and this may help explain a lower incidence of readmissions compared to other studies.

Higher serum creatinine at the time of index hospitalization, a marker of more severe renal compromise, was independently correlated with an increased risk of death and/or readmission in our study, which has also been consistently seen among other studies.[13, 16]

Patients with low total cholesterol, low LDL in our study were more likely to die and/or readmitted in the univariate analysis which is consistent with other studies[17] where the relative risk of mortality was doubled with the lowest total cholesterol in patients with advanced CHF. Increased mortality risk at lower lipid and lipoprotein levels has been observed in various disease states and populations. Adverse outcomes associated with low serum cholesterol have been reported in trauma, surgical illness, multiple organ failure, and sepsis.[18,19,20,21] Investigations into the pathophysiology behind the cholesterol-survival association in sepsis have

focused on a role for lipoprotein in down regulating the inflammatory immune response via an interaction between lipoproteins and bacterial lipopolysaccharide (LPS). LDL and HDL have been shown to bind LPS and to protect against immediate toxic effects of LPS on endothelial cells.[22] A similar down regulation of inflammatory activity has been theorized in CHF patients.[23] on the other hand, it is also possible that low cholesterol is merely a consequence of advanced CHF and has no pathophysiological role. It may also portend poor prognosis because low cholesterol is a marker for cachexia, a state associated with poor CHF mortality.[24] In our study, total cholesterol was, however, a predictor of death and/or readmission independent of BMI; therefore cachexia can not fully explain these observations.

Interestingly, death and/or readmission was not correlated with diminished left ventricular ejection fraction (EF) i.e., EF < 45%. However similar findings have been reported in the past.[13] Systolic dysfunction may be a predictor for long term prognosis as shown in SOLVD study however our study had a relatively short mean follow up of 6 months and thus may not reflect the significance of systolic dysfunction.

Preexisting AF in patients with CHF or new onset AF, both have been shown to affect survival.[25] The impact of AF on CHF mortality has been examined extensively but remains controversial. In V-Heft trial [26] baseline AF was not related to overall mortality or sudden death, however in the SOLVD [27] trial AF was associated with increased mortality. AF was also an independent predictor of mortality among the AVID registry.[28] Contrary to this, two studies have reported that AF has a beneficial impact on prognosis in CHF.[29, 30] AF was a predictor of death and/or rehospitalization in our study on univariate but not on multivariate analysis. It is possible that the high mortality associated with CHF itself overwhelmed the modest influence of preexisting AF, particularly after adjusting for other cardiovascular conditions. The adverse impact of AF in CHF patients is most likely multifactorial. The development of AF may be a marker of deterioration of ventricular function or increased neurohormonal activation. Alternately, AF may play a causal role via loss of atrial transport, accelerated ventricular response, or thromboembolism.[27, 31]

Pulmonary hypertension was the most significant predictor of death and/or readmission in both univariate and multivariate analysis. Although pulmonary hypertension in patients with LV dysfunction is a predictor of poor outcome it is frequent and highly variable in patients with LV

dysfunction and it is not independently related to the degree of LV dysfunction but is strongly associated with diastolic dysfunction and the degree of functional mitral regurgitation,[32] consistent with our study where it was the most significant predictor rather than LV systolic function. This finding may be explained by the presence of preexisting pulmonary parenchymal compromise or left ventricular dysfunction and since a medical history of COPD was not significantly different preexisting LV dysfunction is more likely an explanation for pulmonary hypertension leading to increased death and/or readmission. Presumably, a smaller amount of fluid overload might be enough to precipitate severe shortness of breath and hospitalization in heart failure patients with pulmonary hypertension compared to those without pulmonary hypertension.[13] Pulmonary hypertension may result from an increase in left atrial pressure[33] and pulmonary resistance [34] and, possibly, from the loss of endothelium-dependent vasodilatation of the pulmonary arterial bed.[35] Pulmonary hypertension is also associated with neurohormonal activation[36],[37] in particularly endothelin-1[38] a potent vasoconstrictor that is increased markedly in advanced heart failure.[39] The respective roles of cardiac and vascular dysfunction in the genesis of pulmonary hypertension associated with LV dysfunction are not fully clarified.

Bundle branch block was the second most significant predictor in our study which is also consistent with the published data that also suggest that prognosis for patients with CHF is worse for those with prolonged QRS than that for those with normal QRS[40] Left bundle branch block (LBBB) is a well known predictor of outcome, but the same has not been confirmed for a right bundle branch block (RBBB). In our study, the incidence of LBBB was identical (11%) between the two groups, however any BBB was higher in the readmission and/or death group (26% vs. 12%, p= 0.03), which may suggest that RBBB may also be a predictor of poor outcome in CHF.

Jugular venous distension, pleural effusion diagnosed on physical exam as well by chest x-ray all suggestive of a congestive profile were significant predictors of readmission and/or death in our study on univariate analysis however only pleural effusion diagnosed on chest x-ray remained significant on multivariate analysis. An elevated jugular venous pressure as a predictor of increased death and/or readmission has been shown by multiple studies. A recent report demonstrated that the presence of elevated jugular

venous pressure and S3 was associated with an increased risk of hospitalization and death among patients enrolled in the Studies Of Left Ventricular Dysfunction (SOLVD) treatment trial.[41], [42] A retrospective study comparing assigned clinical profiles to invasive hemodynamics,[41], [43] as well a prospectively designed study [41] showed that patients with a "wet" profile i.e. with the presence of signs of congestion on physical exam, tended to have a higher PCWP than those with a "dry" profile i.e. without signs of congestion. Another study evaluating patients four to six weeks after treatment for NYHA class IV symptoms also showed that persistent evidence of congestion predicted worse outcomes in patients with chronic CHF.[44]

The majority of previous reports discussing risk stratification in chronic CHF among African Americans and Hispanics have focused on patients with significant systolic dysfunction. [45] Our study is the first to assess African Americans and Hispanics with chronic CHF across a wide range of EF, as one would expect to see in daily clinical practice. Our data provide a novel approach to identify patients with chronic CHF with and without preserved LV systolic function, who are at increased risk of readmission and/or death preceded by decompensated CHF.

STUDY LIMITATIONS

Our study is limited by the retrospective design and the possibility that those readmissions in other hospitals may not have been captured, and the inherent limitation of multivariate models to predict a complex process, such as readmission, in a relatively small cohort.

CONCLUSION

Among African-American and Hispanic patients hospitalized for CHF following were the most significant predictors of readmission and/or death: pulmonary hypertension, any bundle branch block i.e., wide QRS, and pleural effusion on chest X-ray. These variables are easily available on routine basic investigations, which can help in the assessment of poor outcomes in patients with CHF. Knowledge of mortality predictors can be used to generate predictive models that can aid clinicians' decision making, in particular by identifying patients who are at high or low risk of death and/or readmission. Further prospective large scale randomized clinical trials among the minorities are warranted.

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