

Does Racial Bias Exist in the Medical Management of Heart Failure?

KISHORE J. HARJAI, M.B., B.S., FACC, EDUARDO NUNEZ, M.D., MEHUL SHAH, M.B., B.S., JEFF NEWMAN

Department of Cardiology, Ochsner Clinic, New Orleans, Louisiana, USA

Summary

Background: It is suspected that effective therapies are often underutilized in black compared with white patients with coronary artery disease (CAD).

Hypothesis: We hypothesized that an unfavorable bias may exist against black patients in the medical management of heart failure.

Methods: In 566 consecutive adult subjects who were discharged alive from the hospital with a principal discharge diagnosis of heart failure, we assessed the effect of patient race on utilization of classes of medications (angiotensin-converting enzyme inhibitors [ACEI], digitalis, diuretic agents) and combinations of medications (effective vasodilators, i.e., ACEI or combined hydralazine and nitrate; effective combination therapy, i.e., effective vasodilator with digitalis and diuretic) known to be beneficial in symptomatic heart failure.

Results: Compared with black patients ($n = 182$), white patients were older, had a higher incidence of coronary artery disease, lower incidence of hypertension, and lower serum creatinine and left ventricular end-diastolic diameter. In crude analyses, the utilization of all medications was similar between white and black patients. After adjustment for clinical differences, black patients were more likely to receive ACEI (adjusted odds ratio [OR] = 1.84; 95% confidence interval [CI] 1.13–3.01), effective vasodilators (OR = 1.97; CI 1.20–3.23), and effective combination therapy (OR = 1.66; CI

1.02–2.69) than white patients at the time of discharge from the hospital. No multivariate association was seen between patient race and use of digoxin or diuretics. In an analysis of subsets of patients with ejection fraction $< 45\%$ ($n = 260$), no association was seen between patient race and utilization of effective medical therapy.

Conclusion: Our results show no unfavorable bias against black patients with decompensated heart failure.

Key words: heart failure, race, angiotensin-converting enzyme inhibitors

Introduction

It is suspected that effective therapies are often underutilized in black compared with white patients with coronary artery disease (CAD). There are surprisingly few data on racial differences in medical treatment for heart failure, despite evidence for worse outcomes in black patients with heart failure.¹ In an analysis of data from the studies of left ventricular dysfunction (LVD) prevention and treatment trials, blacks with mild to moderate LV systolic dysfunction were at higher risk for progression of heart failure and death from any cause than similarly treated whites.² National statistics show that the rate of death from heart failure in 1990 was about four times higher in black than in white subjects.³

In this study, we attempted to evaluate the impact of patients' race on the utilization of effective medical therapy for heart failure. We hypothesized that in patients discharged from the hospital with a principal diagnosis of heart failure, effective medical therapy was less likely to be utilized in black than in white subjects.

Methods

Patient Selection and Data Collection

Over a consecutive 12-month period from September 1994 to August 1995, 614 hospitalizations for diagnosis-related group (DRG) 127 (heart failure and shock) were recorded at

Address for correspondence:

Kishore J. Harjai, M.B., B.S., FACC
Division of Cardiology
William Beaumont Hospital
3601 W. 13 Mile Road
Royal Oak, MI 48073, USA
e-mail: kharjai@beaumont.edu

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the Ochsner Foundation Hospital. This hospital is located in suburban New Orleans and receives patients from a large multispecialty group practice of over 400 physicians. Of the total cohort, 592 adult patients were discharged alive from the hospital. We excluded 10 patients whose race was classified as Hispanic or "other," and 1 patient who was noncompliant with medical therapy and had 16 hospitalizations during the study period. Thus, the study population included 566 patients, consisting of 384 white and 182 black subjects. Using administrative and clinical databases maintained at this institution, we obtained information relating to patient age, gender, utilization of heart failure medication at the time of discharge from the hospital (specifically angiotensin-converting enzyme inhibitors [ACEI], digoxin, diuretics, nitrates, hydralazine), selected clinical characteristics such as admission vital signs and serum chemistry values, comorbid conditions (hypertension, CAD, atrial fibrillation, chronic obstructive pulmonary disease), and echocardiographic variables (LV ejection fraction, septal thickness, posterior wall thickness, LV end-diastolic diameter, right-ventricular [RV] systolic function, and left atrial diameter). Details of the echocardiographic technique used at our institution have been described previously.⁴ Clinical records were reviewed when such information was not available from the databases.

Of the 566 patients, 409 had known LV ejection fraction, assessed by echocardiography performed prior to or during the index hospitalization. In 260 patients, LV ejection fraction was known to be <45%.

Study Definitions and Outcomes

For the purpose of this study, we defined effective vasodilator therapy as utilization of either an ACEI or a combination of hydralazine and nitrate at the time of discharge. Effective combination therapy was defined as combination of effective vasodilator therapy with digitalis and a diuretic agent. The actual doses employed at the time of discharge were not included in the analysis.

The outcomes of the study were the frequencies with which individual classes of medications (ACEI, diuretics, digoxin), effective vasodilator therapy, and effective combination therapy were utilized at the time of discharge from the hospital. Use of beta blockers was not monitored for the purpose of this study, since the study period preceded the publication of recent clinical trials documenting the benefits of beta-blocker therapy in patients with heart failure.⁵⁻⁷

Statistical Analysis

Continuous variables are expressed as mean \pm one standard deviation (SD), and discrete variables as percentages. Differences between groups for continuous variables were assessed using the Wilcoxon rank sum test. For categorical variables, differences between patient groups were assessed using contingency tables. Univariate analyses were performed to assess differences in clinical and echocardiographic variables between white and black patients. Also, a univariate relation was

sought between demographic, clinical, and echocardiographic variables and the utilization of medications at the time of hospital discharge.

The independent effect of patient race on utilization of medical therapy at the time of discharge was evaluated using mixed stepwise multiple logistic regression. For each class of medication or group of medications listed under study outcomes, we constructed multivariate models relating patient race to utilization of that particular class of medication or group of medications. Patients race was forced into the multivariate equations. Demographic, clinical, and echocardiographic variables, shown in Table I, were included in the model for each medication or group of medications. The results were expressed as odd ratios (OR) and confidence intervals (CI).

Results

Patient Characteristics

Demographic, clinical, and echocardiographic characteristics of the study patients are shown in Table I. Thus, compared with blacks, whites were older and more likely to be male. Whites had a lower number of hospitalizations for any reason within the 6 months preceding the index hospitalization. During the index hospitalization, both groups of patients had a similar length of stay and similar frequency of need for intensive care. Whites were more likely to be under the primary care of a cardiologist; they had a higher incidence of CAD and atrial fibrillation, and a lower incidence of hypertension as well as lower systolic and diastolic blood pressures at the time of admission. In addition, they had lower serum creatinine and sodium levels, but similar blood urea nitrogen level at the time of hospitalization. There was no difference between patient groups in the frequency with which echocardiographic examination had been performed prior to or during the index hospitalization, or in the incidence of LV systolic dysfunction (i.e., ejection fraction <45%); however, whites had larger left atrial and smaller LV end-diastolic diameters than blacks.

Utilization of Effective Medical Therapy

The crude frequencies of utilization of medications in white and black patients are shown in Table II. For all classes of medications shown, there were no significant differences between white and black patients. A tendency toward greater use of effective vasodilator therapy in black compared with white patients was seen in the analysis of the total cohort (77 vs. 70%, $p = 0.07$).

After multivariate adjustment for clinical differences, black patients were more likely to receive ACEIs (adjusted OR = 1.84; 95% CI 1.13–3.01), effective vasodilator therapy (adjusted OR = 1.97; 95% CI 1.20–3.23), and effective combination therapy (adjusted OR = 1.66; 95% CI 1.02–2.69) compared with white patients (Fig. 1A). No multivariate association was seen between patient race and use of digoxin or diuretic agents. Variables that remained significantly associ-

TABLE I Clinical characteristics of patients hospitalized with heart failure

	Whites (n = 384)	Blacks (n = 182)	p Value
Age, years	72 ± 13	65 ± 15	<0.0001
Male gender (%)	225 (59)	80 (44)	0.001
Recent hospitalizations ^a	0.7 ± 1.0	1.6 ± 3.3	0.06
Length of stay during index hospitalization	3.9 ± 2.8	4.0 ± 3.2	NS
Cardiologist care during index hospitalization (%)	269 (70)	97 (53)	<0.0001
Intensive care stay during index hospitalization (%)	36 (9)	20 (11)	NS
Coronary artery disease (%)	177 (46)	54 (30)	0.0002
Atrial fibrillation (%)	153 (40)	32 (18)	<0.0001
Hypertension (%)	199 (52)	117 (64)	0.005
Chronic obstructive pulmonary disease (%)	58 (15)	29 (16)	NS
Systolic blood pressure, mmHg	134 ± 29	146 ± 36	0.0004
Diastolic blood pressure, mmHg	75 ± 16	84 ± 22	<0.0001
Serum sodium, mEq/l	137 ± 5	138 ± 4	0.001
Blood urea nitrogen, mg/dl	28 ± 17	28 ± 19	NS
Serum creatinine, mg/dl	1.6 ± 1.0	2.0 ± 1.7	0.036
Echocardiography performed before or during hospitalization (%)	277 (72)	132 (72)	NS
Left ventricular ejection fraction < 45% ^b (%)	167 (60)	93 (66)	NS
Left atrial diameter, cm, parasternal view ^b	4.9 ± 0.9	4.6 ± 0.8	0.01
Left ventricular end-diastolic diameter, cm ^b	5.3 ± 1.1	5.5 ± 1.0	0.047

Numbers in parentheses represent percentages, rounded off to the nearest integer value.

^a Number of hospitalizations in the prior 6 months.

^b Data based on 409 patients in whom echocardiographic examination had been performed before or during the index hospitalization.

TABLE II Frequency of use of medications at hospital discharge

Medication	Whites	Blacks
All patients	n = 384	n = 182
Angiotensin-converting enzyme inhibitors (%)	246 (64)	127 (70)
Effective vasodilator therapy ^a (%)	268 (70)	140 (77)
Digoxin (%)	243 (63)	112 (62)
Diuretic agent (%)	351 (91)	172 (95)
Effective combination therapy (%)	186 (48)	97 (53)
Patients with known left ventricular dysfunction ^b	n = 167	n = 89
Angiotensin-converting enzyme inhibitors (%)	125 (75)	67 (75)
Effective vasodilator therapy (%)	141 (84)	77 (87)
Digoxin (%)	130 (78)	70 (79)
Diuretic agent (%)	151 (90)	82 (92)
Effective combination therapy (%)	107 (64)	61 (69)

Numbers in parentheses represent percentages, rounded off to the nearest integer value.

^a p = 0.07.

^b Left ventricular ejection fraction < 45%.

ated with utilization of each of the medication classes in the final multivariate models are shown in Table III.

Subset Analysis

Similar univariate and multivariate analyses were performed among patients with LV ejection fraction < 45% (n = 260). No significant association was seen between race and utilization of any class or group of medications (Fig. 1B).

Discussion

Our analysis disproves our hypothesis that effective medical therapy is underutilized in black compared with white patients with symptomatic heart failure. In crude analyses, no differences were found between black and white subjects with respect to the utilization of any class or group of medications, known to be beneficial in patients with heart failure. Furthermore, after multivariate adjustment for clinical and echocar-

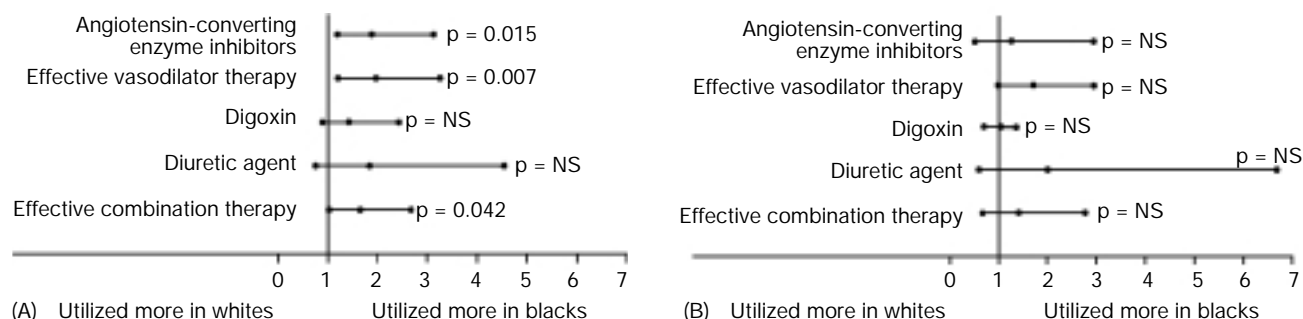


FIG. 1 Multivariate odds ratios and confidence intervals for utilization of heart failure medications in black versus white patients at the time of discharge from the hospital. (A) All patients, (B) patients with known left ventricular (LV) dysfunction (LV ejection fraction $\leq 45\%$). NS = not significant.

TABLE III Significant multivariate correlates of utilization of medications for heart failure

Medication class	Multivariate correlates
ACE inhibitors	Serum creatinine at the time of hospitalization ^a Black race
Effective vasodilator therapy	Male gender Digoxin use Serum creatinine at the time of hospitalization ^a Black race
Digoxin	In-patient care by cardiologist Systolic blood pressure at the time of hospitalization ^a Atrial fibrillation Heart rate at the time of hospitalization Serum creatinine at the time of hospitalization ^a In-patient care by cardiologist Age ^a
Diuretics	Hospitalization (any cause) in the last 6 months Length of stay ^a Serum creatinine at the time of hospitalization ^a Diastolic blood pressure at the time of hospitalization Age ^a
Effective combination therapy	Hospitalization (any cause) in the last 6 months Systolic blood pressure ^a Serum creatinine at the time of hospitalization ^a Hospitalization (any cause) in the last 6 months Male gender In-patient care by cardiologist Black race

Within each medication class, correlates are arranged in descending order of significance.

^a Lower values of these variables were associated with higher utilization of the respective medication class.

diographic differences, ACEIs, effective vasodilator therapy, and combination therapy were all more likely to be utilized among black than among white patients. Notably, no significant racial differences in utilization were seen within the subgroup of patients who were known to have depressed ejection fraction. Thus, it is likely that at least part of the higher adjusted utilization of ACEIs, effective vasodilator therapy, and combination therapy in black compared with white patients in the total cohort relates to the higher incidence of depressed

ejection fraction in black patients (66 vs. 60%). Data on LV ejection fraction were not available in all patients, and hence were not used in the multivariate analysis of the total cohort.

Differences in utilization of medical therapies and interventions across patient populations are often related to potential differences in access to medical care,⁸ disease prevalence and severity, and socioeconomic and cultural factors.⁹ The design employed by our study obviates any confounding effect from lack of access to care or differences in disease severity, since

patients in our study were all hospitalized for symptomatic heart failure, and by definition had symptomatic heart failure and full access to care.

Despite known differences in clinical outcomes between white and nonwhite patients with heart failure,¹⁻³ existing literature on the effect of patient race on processes of care in heart failure is rather sparse. In an analysis of 9,105 adults hospitalized with one of nine illnesses associated with an average 6-month mortality of 50%, the Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatment (SUPPORT) investigators found that seriously ill black patients received less resource-intensive care than other patients after adjustment for severity of illness.¹⁰ Thus, black patients had less procedures, lower hospitalization cost, and a lower incidence of care by cardiologists. Differences in resource use were less marked, but remained significant after adjustment for specialty of the caregiver physician. Illnesses included in this study were acute respiratory failure, chronic obstructive lung disease, congestive heart failure, cirrhosis, nontraumatic coma, metastatic colon cancer, advanced non-small-cell lung cancer, multiple organ system failure with sepsis, or multiple organ systems failure with malignancy. In the subset of patients with heart failure, black patients were less likely to be under the care of the cardiologist. Contrary to the findings of the SUPPORT investigators, Philbin and DiSalvo found higher hospitalization utilization, measured as length of stay and hospital charges, among black patients hospitalized with heart failure.⁹

It is not known whether differences in clinical outcomes between black and white patients with heart failure are related to inherent biological characteristics or to differences in clinical management strategies. It is plausible, yet unproven, that worse outcomes seen in blacks in some studies^{1,3} may be related to inadequate access to treatment or underutilization of effective strategies. On the contrary, the higher risk of progression of heart failure and death from any cause among blacks enrolled in the SOLVD trials are unlikely to be related to access issues; the SOLVD data suggest that differences in the natural history of ischemic and nonischemic LV dysfunction account for differences in clinical course between black and white patients.²

Study Limitations

Our study has several limitations, including, perhaps most important, the lack of generalizability of our results. Our study is a single-center study. Quite unlike community settings where in-patient care for heart failure may be imparted predominantly by noncardiologists, 366 (65%) patients from our cohort were under the direct care of cardiologists during the index hospitalization. Our center has a dedicated team of heart failure physicians and personnel; in prior experience, this team has been directly responsible for the in-patient care of 10–11% of the total number of DRG 127 hospitalizations. Furthermore, our study does not rule out the possibility of self-selection bias, that is, patients who chose to receive their care at our center may not represent the universe of patients with heart failure from the same geographic region. In addition, dis-

charge medications do not represent the entire spectrum of medical therapy, but are only an index of utilization at one point in time. In a chronic condition such as heart failure, medical therapy is often modified in an outpatient setting, after discharge from the hospital, to achieve optimum long-term outcomes. Postdischarge utilization of medications was not measured in our analysis.

Several other modalities of treatment are often used in the management of subjects with heart failure. These include invasive procedures, such as angiography or angioplasty, cardiac surgery for CAD or valvular lesions, and, in advanced heart failure, referral for heart transplantation, chronic outpatient inotropic therapy, or device therapy. The utilization of these modalities was not monitored for the purpose of this study. Finally, by design, our study does not attempt to estimate the clinical impact of utilization of effective medical therapy on outcomes such as readmission rates and mortality.

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