Clinical Investigations

Effects of β-Adrenergic Blockade on Left Ventricular Remodeling Among Hispanics and African Americans With Chronic Heart Failure

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ABSTRACT

Background: Although β-blockers (BBs) have been shown to improve cardiac function, there is individual and ethnic variation in BB clinical response. We examined the effects of BBs on left ventricular remodeling among African Americans (AAs), Hispanics, and Caucasians with systolic heart failure.

Hypothesis: There is ethnic variability in the effects of BBs on cardiac remodeling.

Methods: There were 185 AAs, 159 Hispanics, and 74 Caucasians selected with ejection fraction ≤40% from any etiology. Change in left ventricular ejection fraction (LVEF), left ventricular end-diastolic dimensions (LVEDD), and degree of mitral regurgitation (MR) in response to 1 year of BBs was evaluated retrospectively.

Results: Overall, there was a significant improvement in LVEF, LVEDD, and degree of MR in AAs and Caucasians after 1 year of BBs ($P < 0.001$ vs baseline). Compared with other races, Hispanics (%) had no significant improvement in LVEDD and degree of MR, and had fewer patients with reverse remodeling: LVEF (42.77%), LVEDD (5.03%), and MR (16.35%). In multivariable analysis, Hispanic and AA race were important predictors of LVEF and LVEDD ($P < 0.01$) but not MR response.

Conclusions: Although most patients demonstrated improvement of LVEF, there seems to be ethnic variability in the effects of BBs on cardiac remodeling. Degree of MR and LVEDD failed to show improvement among Hispanics.

Introduction

Heart failure (HF) is a significant health problem[1,2] that is associated with high rates of morbidity and mortality, especially in African Americans (AAs) and Hispanics.[1,3,4] The higher mortality in these groups has been attributed to differences in the severity and causes of HF, the prevalence of coexisting conditions and risk factors,[2] socioeconomic and cultural factors, and access to high-quality medical care.[5]

β-blockers (BBs) are beneficial in patients with symptomatic HF or left ventricular (LV) systolic dysfunction.[6–8] However, response to β-blockers may vary among different ethnic groups.[9–11] Overall, BBs have been shown to have similar benefits in both AAs and Caucasians.[12,13] Previous HF studies have generally been limited to comparisons between AAs and Caucasian populations,[2] but there are few comparative statistics concerning HF in Hispanics, 1 the fastest-growing segments of the US population.[14]

Although substantial information is available on racial differences in mortality and risk factors, much less is known about racial differences in noninvasive measures of HF, such as parameters of LV remodeling. LV remodeling parameters such as left ventricular ejection fracture (LVEF), left ventricular end-diastolic diameter (LVEDD), and degree of mitral regurgitation (MR) have prognostic significance in patients with HF.[15] Data accounting for the influence of BB treatment on parameters of LV remodeling in Hispanic population are scarce.

In this project, we aimed to assess the magnitude of improvement of LV function and other parameters of remodeling after use of BBs, analyze the predictors responsible for the individual variation, and evaluate the different effect of BB therapy on LVEF and other parameters of remodeling in Hispanic patients with HF compared with other ethnic groups.

Funding for this project was provided by the Congestive Heart Failure Division Fund, Montefiore Medical Center. These data were presented in part at the 13th Annual Scientific Meeting of the Heart Failure Society of America, September 2009, Boston, Massachusetts.
Dr. Kelesidis contributed to collecting the data, quantitation of echocardiograms, data analysis, and writing and editing the manuscript. Dr. Varughese contributed to collecting the data, data analysis, and writing and editing the manuscript. Dr. Hourani contributed to collecting the data, and writing and editing the manuscript. Dr. Zolty contributed to conceiving the study, quantitation of echocardiograms, data analysis, and writing and editing the manuscript.
The authors have no other funding, financial relationships, or conflicts of interest to disclose.

Received: April 19, 2013
Accepted with revision: May 21, 2013

Table 1. Clinical Characteristics Between African American, Hispanic, and Caucasian Heart Failure Patients

	Overall (n = 418)	Caucasians (n = 74)	Hispanics (n = 159)	African Americans, (n = 185)	*P* Value
Male, n (%)	268 (64.11%)	44 (59.46%)	108 (67.92%)	116 (62.70%)	0.39
Age, y, median (IQR)	64 (55–72)	67 (57–71)	64 (55–73)	62 (55–69)	0.06
Diabetes, n (%)	206 (49.28%)	38 (51.35%)	87 (54.72%)	81 (43.78%)	0.12
HTN, n (%)	308 (73.68%)	52 (70.27%)	127 (79.87%)	129 (69.73%)	0.07
Nonischemic cardiomyopathy, n (%)	238 (56.64%)	52 (70.27%)	78 (49.06%)	108 (58.38%)	<0.01
NYHA class, n (%)					<0.01
I	46 (11%)	6 (8.11%)	10 (6.29%)	30 (16.22%)	
I–II	40 (9.57%)	8 (10.81%)	16 (10.06%)	16 (8.65%)	
II	142 (33.97%)	30 (40.54%)	63 (39.62%)	49 (26.49%)	
II–III	92 (22.01%)	12(16.22%)	29 (18.24%)	51 (27.57%)	
>III	98 (23.44%)	18 (24.32%)	41 (25.78%)	39 (21.08%)	
ICD, n (%)	122 (29.19%)	22 (29.73%)	43 (27.04%)	57 (30.81%)	0.74
Valvular disease, n (%)	90 (21.63%)	20 (27.03%)	32 (20.38%)	38 (20.54%)	0.46
Dyslipidemia, n (%)	306 (73.21%)	44 (59.46%)	120 (75.47%)	142 (76.76%)	0.01
CKD, n (%)	122 (29.19%)	16 (21.62%)	59 (37.11%)	47(25.41%)	0.02
Smoking, n (%)	226 (54.07%)	42 (56.76%)	73 (45.91%)	111 (60.00%)	0.03
Alcohol, n (%)	130 (31.10%)	30 (40.54%)	45 (28.30%)	55 (29.73%)	0.15

Abbreviations: CKD, chronic kidney disease; HTN, hypertension; ICD, implantable cardioverter defibrillator; IQR, interquartile range; NYHA, New York Heart Association.
P value for comparison between ethnic groups.

Methods

Study Population

A total of 418 patients, ages 18 to 80 years old, with baseline LVEF ≤40% utilizing BBs (carvedilol, metoprolol succinate or tartrate), who were followed at the HF clinic of Weiler Hospital of the Albert Einstein College of Medicine (AECOM) were analyzed retrospectively. Patients with hypertrophic cardiomyopathy, hemodynamically significant valvular lesions, severe bronchospastic lung disease, baseline heart rate (HR) <60 beats per minute, or systolic blood pressure (BP) <90 mm Hg were excluded. Patients who had coronary revascularization within 3 months before the initiation of BBs were also excluded.

Study Design

The clinical design was a retrospective study aimed at analyzing the effects of BBs on cardiac reverse remodeling among a multiethnic population. Approval was granted from the AECOM institutional review board. BBs were titrated up to the maximum tolerable dose without a predefined time schedule. The maximum tolerable dose was the daily dose over which there was either (1) aggravation of dyspnea or edema, (2) systolic BP <90 mm Hg or HR <60 beats per minute at rest, or (3) a need to increase the concomitant medication for HF. The assignment of race was done by physicians and nurse coordinators. The charts of patients who had LVEF, LVEDD, and degree of MR measured using 2-dimensional echocardiography and the modified Simpson's rule at baseline (time point of available data when patient was not receiving BBs), and 12 months after a stable dose of BBs were reviewed. LV dysfunction was defined as an LVEF ≤0.40. LVEF was our primary measure of systolic function. Degree of MR was utilized for valvular function, whereas measures of diastolic function were analyzed using the LVEDD, which has been shown in previous studies to be a strong factor in predicting occurrence of reverse remodeling.[2] Severity of MR was originally classified as none, mild, moderate, moderate-severe, or severe as per interpreting echocardiographer.

As in previous studies,[7,16] LVEF responders to β-blockade were defined as patients with an absolute increase in LVEF ≥5% after a maximal doses of BBs. Similar to other studies,[17,18] LVEDD responders to BBs were defined as patients with an absolute improvement in LVEDD ≥10% from baseline after maximal doses of BBs. LVEF decline was defined as patients with a decline in LVEF ≥5%, and LVEDD decline was defined as worsening of LVEDD ≥10% from baseline. MR response was defined as ≥1 degree improvement after maximal doses of BBs. MR decline was

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DOI:10.1002/clc.22164

Table 2. Differences in Medications Used in African American, Hispanic, and Caucasian Patients With Chronic Heart Failure

Medications	Overall, (n = 418)	Caucasians (n = 74)	Hispanics (n = 159)	African Americans (n = 185)	*P* Value
Carvedilol, n (%)	220 (52.63%)	42 (56.76%)	78 (49.06%)	100 (54.05%)	0.48
Carvedilol dose, mg, median (IQR)	25 (12.5–50)	25 (12.5–50)	37.5(18.75–50)	31.25 (12.5–50)	0.42
Low dose carvedilol, n (%), 6.25 mg PO bid	59 (26.82%)	12 (28.57%)	19 (24.36%)	28 (28.00%)	0.59
Medium-dose carvedilol, n (%), 12.5 mg PO bid	73 (33.18%)	14 (33.33%)	23 (29.48%)	36 (36.00%)	0.44
High-dose carvedilol, n (%), 25 mg PO bid	88 (40%)	16 (38.09%)	36 (46.15%)	36 (36.00%)	0.76
Metoprolol, n (%)	198 (47.37%)	32 (43.24%)	81 (50.94%)	85 (45.95%)	0.48
Metoprolol dose, mg, median (IQR)	100 (50–150)	100 (50–175)	100 (50–150)	75 (50–125)	0.08
Low-dose metoprolol, 25 mg PO bid	88 (44.44%)	14 (43.75%)	27 (33.33%)	47 (55.29%)	0.14
Medium-dose metoprolol, n (%), 50 mg PO bid	55 (27.78%)	7 (21.87%)	30 (37.03%)	18 (21.17%)	0.02
High-dose metoprolol, n (%), >75 mg PO bid	55 (27.78%)	11 (34.37%)	24 (29.63%)	20 (23.53%)	0.45
Overall dose of BB (combined), n (%)					
Low	147 (35.17%)	26 (35.14)	46 (28.93%)	75 (40.54%)	0.08
Medium	128 (30.62%)	21 (28.38%)	53 (33.33%)	54 (29.19%)	0.64
High	143 (34.21%)	27 (36.49%)	60 (37.74%)	56 (30.27%)	0.31
ACEI or ARB	398 (95.22%)	68 (91.89%)	155 (97.48%)	175 (94.59%)	0.15
Hydralazine	366 (87.56%)	70 (94.59%)	145 (91.19%)	151 (81.62%)	0.08
Nitrates	336 (80.38%)	66 (89.19%)	112 (70.44%)	158 (85.41%)	0.08
Spironolactone	200 (47.85%)	36 (48.65%)	78 (49.06%)	86 (46.49%)	0.88
Digoxin	184 (44.02%)	34 (45.95%)	71 (44.65%)	79 (42.70%)	0.87
Calcium channel blocker	74 (17.70%)	10 (13.51%)	30 (18.87%)	34 (18.38%)	0.58

Abbreviations: ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; BB, β-blocker; IQR, interquartile range; PO bid, orally twice a day.
P value for comparison between different racial groups.

defined as ≥1 degree of MR deterioration after maximal doses of BBs. A high dose of BBs was defined similarly to prior studies.[6,7,19] For example, a high dose of metoprolol was defined as ≥150 mg orally daily, whereas a high dose of carvedilol was defined as ≥50 mg orally daily.

Statistical Analyses

Statistical analyses were performed using Stata version 12.0 statistical software (StataCorp, College Station, TX). A P value <0.05 was considered statistically significant. Continuous data are presented as median and interquartile range in variables that were not normally distributed, whereas categorical data are presented as number (percent of patients). Comparisons between groups were made using 2-sample t test, 1-way analysis of variance, or the nonparametric equivalent for continuous variables and χ^2 test or Fisher exact test for categorical data. Pearson and Spearman correlation coefficients (r) were used to quantify associations between variables. The effect of β-blockade on LVEF and LVEDD change after 1 year were compared using paired t test or the nonparametric equivalent. Wilcoxon signed rank test was utilized to analyze change in degree of MR after 1 year of BB therapy.

A simple and multivariable linear regression analysis was performed between the changes of LVEF (ΔLVEF) and LVEDD (ΔLVEDD) from baseline to stable dose and the available covariates including patient characteristics, and concomitant medication to identify predictors of improvement after BBs and how these predictors differ among ethnic groups. To determine important predictors of reverse remodeling, we also performed multivariable logistic regression using LVEF response, LVEDD response, and MR response as binary outcomes separately.

Results

Clinical Characteristics

This study consisted of a total of 418 patients; there were 159 Hispanics, 185 AAs, and 74 Caucasians. The clinical characteristics of the study cohort stratified by race are displayed in Table 1. Overall, the median age was 64 years. As shown, Hispanics had less nonischemic cardiomyopathy

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DOI:10.1002/clc.22164

Table 3. Differences in Echocardiographic Remodeling Parameters Between African American, Hispanic, and Caucasian Heart Failure Patients

	Overall	Caucasians (n = 74)	Hispanics (n = 159)	African Americans (n = 185)	*P* Value
LVEF baseline, median (IQR)	30 (25–36)	27 (22–32)	33 (25–38)	30 (25–37)	0.001
LVEF after 1 year of BB, median (IQR)	35 (29–42)	35 (30–40)	34 (25–40)	35 (30–42)	0.001
LVEF responders (≥5% LVEF increase)	252 (60.29%)	72 (97.30%)	68 (42.77%)	112 (60.54%)	< 0.001
LVEF decline (≥5% LVEF decline)	68 (16.27%)	0	39 (24.53%)	29 (15.68%)	< 0.001
LVEDD baseline, mm, median (IQR)	61 (56–67)	66 (60–69)	60 (55–65)	62 (57–68)	< 0.001
LVEDD after 1 year of BB, median (IQR)	60 (55–66)	60 (54–63)	60 (55–66)	60 (55–67)	0.307
LVEDD responders, n (%), >10% response	84 (20.10%)	30 (40.54%)	8 (5.03%)	46 (24.86%)	< 0.001
LVEDD decline, n (%), >10% decline	28 (6.70%)	0	17 (10.69%)	11 (5.95%)	0.008
Degree of MR at baseline, median (IQR)	2 (1–2)	2 (1–3)	2 (1–2)	2 (1–3)	< 0.01
Degree of MR after 1 year, median (IQR)	1 (1–2)	1 (1–2)	1 (1–2)	0 (1–2)	0.25
MR responders, ≥1 degree of MR improvement, n (%)	114 (27.27%)	46 (62.16%)	26 (16.35%)	42 (22.70%)	< 0.001
Degree of MR decline, n (%), ≥1 degree of MR decline	34 (8.13%)	0	15 (9.43%)	19 (10.27%)	0.018

Abbreviations: BB, β-blocker; IQR, interquartile range; LVEDD, left ventricular end-diastolic dimensions; LVEF, left ventricular ejection fraction; MR, mitral regurgitation.
Measurements at baseline and after 1 year of BBs are shown. *P* value for comparison between different racial groups.

(49.06%), fewer patients with New York Heart Association (NYHA) class I (6.29%) and more patients with higher than class III NYHA (25.78%) ($P < 0.01$) compared to other races. Regarding medication use (Table 2), 220 patients (52.63%) received carvedilol, whereas 198 patients (47.37%) received metoprolol.

LV Remodeling Improvement After β-Blockade

Table 3 shows baseline parameters of LV remodeling (LVEF, LVEDD, degree of MR) and their respective values after 1 year of β-blockade. Compared to other races ($P < 0.01$), Hispanics had worse LVEF (34%), had the least improvement in LVEF (2%), had fewer patients with LVEF response (42.77%) and more patients with LVEF decline (24.53%), had no improvement in LVEDD, had fewer patients with LVEDD response (5.03%) and more patients with LVEDD decline (10.69%), had no improvement in degree of MR and fewer patients with degree of MR response (16.35%). When we stratified our analysis by categories of response (remodeling responders vs nonremodeling responders), we found similar results (Table 3).

Clinical Predictors of Reverse Remodeling

In bivariate analysis, there was a significant correlation of median change of LVEF (δLVEF) with Hispanic race ($r = -0.270$, $P < 0.001$), Caucasians ($r = 0.456$, $P < 0.001$), ischemic cardiomyopathy ($r = -0.141$, $P < 0.001$), NYHA ($r = <0.73$, $P < 0.001$), alcohol use ($r = 0.127$, $P < 0.05$), BB dose ($r = 0.136$, $P < 0.001$). Similar results were noted for LVEF response and LVEF decline. Moreover, there was a significant correlation of median change of LVEDD (δLVEDD) with Hispanic race ($r = -0.304$, $P < 0.001$), Caucasians ($r = 0.270$, $P < 0.001$), ischemic cardiomyopathy ($r = -0.175$, $P < 0.001$), and angiotensin-converting enzyme inhibitor (ACEI)/angiotensin receptor blocker (ARB) ($r = -0.197$, $P < 0.001$). Similar results were noted for LVEDD response and LVEDD decline. Finally, MR response had a significant association with Hispanic race ($r = -0.194$, $P < 0.001$) and Caucasians ($r = 0.366$, $P < 0.001$) but not with BB dose or ACEI/ARB.

Multivariable linear regression (Table 4) revealed that Hispanic and AA race were negative predictors of change in LVEF in contrast to Caucasians. In the adjusted analysis, significant predictors of LVEF change were NYHA class ($P < 0.01$), medium dose of BB ($P < 0.01$), high dose of BB ($P < 0.05$) but not ACEI/ARB, gende and age. Similarly to LVEF change, different races ($P < 0.001$) and a high dose of BBs ($P = 0.05$) were important predictors of LVEDD change (δLVEDD). Differences of individual predictors of remodeling stratified by racial groups are also shown.

Similar results were noted in multivariable logistic analysis (Table 5). Hispanic race was a significant predictor of LVEF response (odds ratio [OR]: = 0.858, $P < 0.001$), LVEDD response (OR: 0.916, $P < 0.01$) but not MR response (OR: 0.988, $P = 0.07$). Finally, when LVEF or LVEDD decline were used as outcomes, we found similar results. Hispanic race was an important predictor of LVEF decline (OR: 2.577, $P < 0.001$) and LVEDD decline (OR: 2.699, $P < 0.05$) but not of MR decline (OR: 1.641, $P = 0.547$).

Discussion

The major finding of this study was that improvement in parameters of cardiac remodeling, such as LVEF, LVEDD, and degree of MR, were not evident after 1 year of BB therapy among Hispanics with chronic HF compared with other races. Compared with other races, Hispanics had

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DOI:10.1002/clc.22164

Table 4. Important Predictors of Change of LVEF and LVEDD (Multivariable Linear Regression Analysis)

	δLVEF		δLVEDD	
Predictors	β (SE)	*P* Value	β (SE)	*P* Value
Overall	Adjusted $R^2 = 0.328$		Adjusted $R^2 = 0.123$	
Hispanics	−5.258 (0.804)	< 0.001	5.079 (0.713)	< 0.001
AAs	−2.477 (0.975)	< 0.001	2.648 (0.689)	< 0.001
Caucasians	6.699 (0.924)	< 0.001	−3.835 (0.657)	< 0.001
Baseline LVEF/LVEDD	−0.232 (0.050)	< 0.001	0.205 (0.030)	< 0.001
Ischemic cardiomyopathy	−0.810 (0.715)	0.258	0.791 (0.521)	0.130
NYHA class	−1.779 (0.564)	0.005	0.115 (0.418)	0.782
Medium dose of BB	2.225 (0.848)	0.009	0.040 (0.604)	0.947
High dose of BB	1.680 (0.835)	0.040	1.203 (0.617)	0.052
ACEI/ARB	−1.059 (1.587)	0.560	−2.514 (1.146)	0.029
Male gender	0.529 (0.854)	0.536	1.059 (0.555)	0.057
Age	0.010 (0.033)	0.751	0.009 (0.021)	0.641
Caucasians (n = 74)	Adjusted $R^2 = 0.197$		Adjusted $R^2 = 0.219$	
Baseline LVEF/LVEDD	−0.243 (0.115)	< 0.05	0.050 (0.074)	0.502
Ischemic cardiomyopathy	−2.131 (2.074)	0.308	−0.905 (1.483)	0.543
NYHA class	−3.577 (1.531)	0.023	−0.918 (1.095)	0.404
Medium dose of BB	2.974 (2.455)	0.230	5.392 (1.755)	0.003
High dose of BB	1.395 (2.225)	0.533	4.744 (1.590)	0.004
Hispanics	Adjusted $R^2 = 0.138$		Adjusted $R^2 = 0.111$	
Baseline LVEF/LVEDD	−0.127 (0.074)	0.09	0.210 (0.039)	< 0.001
Ischemic cardiomyopathy	0.247 (1.105)	0.823	−2.137 (0.662)	0.002
NYHA class	−1.243 (0.957)	0.196	−0.220 (0.573)	0.701
Medium dose of BB	−0.370 (1.402)	0.792	−1.166 (0.840)	0.167
High dose of BB	1.608 (1.336)	0.230	−2.463 (0.800)	0.002
AAs	Adjusted $R^2 = 0.127$		Adjusted $R^2 = 0.072$	
Baseline LVEF/LVEDD	−0.334 (0.083)	< 0.001	0.150 (0.051)	0.004
Ischemic cardiomyopathy	−3.159 (1.096)	0.004	−0.997 (0.825)	0.228
NYHA class	−1.352 (0.849)	0.113	0.561 (0.639)	0.381
Medium dose of BB	3.489 (1.318)	0.009	1.212 (0.993)	0.224
High dose of BB	1.922 (1.338)	0.153	−0.044 (1.008)	0.965

Abbreviations: AAs, African Americans; ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; BB, β-blocker; δLVEDD, change in left ventricular end-diastolic dimensions; δLVEF, change in left ventricular ejection fraction; NYHA, New York Heart Association; SE, standard error. Overall and stratified analysis by race.

Published online in Wiley Online Library (wileyonlinelibrary.com)
DOI:10.1002/clc.22164

Table 5. Important Predictors of Reverse Remodeling (Multivariable Logistic Regression)

	LVEF Response, N = 252		LVEDD Response, N = 84		MR Response, N = 114	
Predictors	OR (95% CI)	*P* Value	OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
Hispanic	0.858 (0.802-0.978)	< 0.001	0.916 (0.838-0.997)	< 0.01	0.988 (0.768-1.262)	0.078
AA	0.964 (0.892-1.018)	< 0.05	0.995 (0.962-1.028)	< 0.05	1.089 (0.896-1.327)	0.082
Baseline value (LVEF, LVEDD, MR)	0.985 (0.951-1.019)	0.396	1.017 (0.982-1.052)	0.329	3.460 (2.577-4.644)	< 0.001
Ischemic cardiomyopathy	0.955 (0.814-1.178)	0.086	1.114 (0.706-1.540)	0.284	1.217 (0.721-2.055)	0.461
NYHA	0.926 (0.797-1.092)	0.06	0.892 (0.611-1.300)	0.552	1.007 (0.876-1.291)	0.07
Medium-dose BB	1.483 (0.942-2.218)	< 0.05	1.337 (0.807-2.216)	0.258	1.188 (0.749-1.884)	0.462
High-dose BB	1.617 (0.987-2.457)	< 0.05	1.288 (0.949-1.884)	< 0.05	1.250 (0.766-2.550)	0.075
ACEI/ARB	1.652 (0.680-2.637)	0.634	1.198 (0.911-1.668)	< 0.05	1.079 (0.637-2.121)	0.212
Gender	1.253 (0.768-2.045)	0.365	1.168 (0.916-1.316)	0.06	1.078 (0.622-1.867)	0.787
Age	1.011 (0.996-1.028)	0.142	0.993 (0.971-1.016)	0.604	1.006 (0.985-1.028)	0.525

Abbreviations: AA, African American; ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; BB, β-blocker; CI, confidence interval; LVEDD, left ventricular end-diastolic dimension; LVEF, left ventricular ejection fraction; NYHA, New York Heart Association; MR, mitral regurgitation; OR, odds ratio.
OR for Hispanic and AA is shown using Caucasian as the reference category, and medium- and high-dose ORs are shown using low-dose BB as the reference category.

fewer patients with LVEF, LVEDD, and MR response. In multivariable adjusted analysis, Hispanic and AA race were important predictors of LVEF and LVEDD ($P < 0.01$) but not MR response. Therefore, there seems to be ethnic variability in the effects of BBs on cardiac remodeling.

The different reverse remodeling to BBs among different ethnic groups can be explained by a few factors.[10,11,20] Due to the diversity of both the patients and drugs, it is difficult to provide a common interpretation in regard to the effects of these agents in AA and Caucasian patients; but in general, similar benefits have been described in both of these races.[13] Exception to this was the Beta-Blocker Evaluation of Survival Trial (BEST) trial, in which AA patients did much worse than Caucasians due to genetic differences.[21] Conflicting data regarding response to different BBs[22,23] may not be a result of study design, but rather an inherent difference in response to therapies. This is supported by a genetic substudy of the BEST data, which evaluated the effects of BBs among differing B gene polymorphisms. Those with certain β-receptor genotypes were associated with the better clinical response to BBs compared to others.[24–28] Moreover, a difference in reverse remodeling can be explained by differences among ethnicities in respect to ancestry/race,[29] socioeconomic factors,[5] and dietary and lifestyle risk factors for CVD.[30] However, our study was not designed to explain why LVEF and LVEDD response seems to differ in different ethnicities. In this regard, the interactions between race and access to high-quality HF care remain important areas for future investigation, and future research aimed at analyzing polymorphisms among Hispanics and AAs may yield interesting results.

Our study showed a beneficial role of BB in remodeling parameters in AAs and Caucasians. These findings are consistent with prior studies that showed that treatment with carvedilol had significantly favorable effects on LV end-diastolic volumes, LVEF, and degree of MR.[7,31,32] In our study, overall the reverse remodeling to BBs was similar in patients with ischemic and nonischemic cardiomyopathy as has been previously shown in other studies.[7,32,33] We also confirmed the finding that the effect of BBs on LV remodeling was similar irrespective of type of BB used (metoprolol or carvedilol).[34–36]

Interestingly, we found that improvement in parameters of cardiac remodeling, such as LVEF, LVEDD, and degree of MR, were not evident after 1 year of BB therapy among Hispanics with chronic HF compared with other races. To our knowledge, this is 1 of the first studies that examined differences in cardiac remodeling between AA and Hispanics. Although the Hispanic population has been shown to comprise a high-risk cardiovascular group,[37–39] there are very limited data on Hispanic patients with chronic systolic HF.[3] AAs have been under-represented in major HF trials, whereas Hispanic patients have been nearly absent in most clinical trials, and thus there are very limited data regarding the effect of medications such as BBs in this ethnic group. Although LV remodeling patterns on Hispanic subgroups compared with non-Hispanic whites have been examined in the Multi-Ethnic Study of Atherosclerosis (MESA) study,[38,39] these patterns have not been associated with the use of BBs. In accordance with these studies, we adjusted our models of remodeling for age, sex, diabetes, smoking, and use of antihypertensive medications,[38,39] and we found similar magnitude difference of abnormal remodeling between Hispanics and Caucasians. Therefore, our data confirm prior findings that Hispanics have differences in ventricular remodeling compared with other races.[40] Finally, we extended this finding by showing that Hispanics have worse LV reverse remodeling compared to other races after 1 year of BBs.

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DOI:10.1002/clc.22164

Our study also showed that BB dose was also 1 of the strongest predictors of remodeling response compared with other predictors such as age, gender, ACEI, and type of cardiomyopathy. Regarding dosing of BBs, in the Multicenter Oral Carvedilol Heart Failure Assessment (MOCHA) trial, carvedilol (12.5–50 mg/day) generated dose-related LVEF improvement (5%–8%) in HF patients, of whom 77% were Caucasians.[6] The carvedilol dose in our patients was about the same dose as that used in the MOCHA trial, but the magnitude of the LVEF improvement for Caucasians in our study was higher. Although this finding is consistent with other studies,[34,35] to the best of our knowledge there are no prior studies regarding BB dosing and LV reverse remodeling in Hispanics.

Finally, in our study we showed that BB use was a stronger predictor of remodeling response than the use of ACEIs. The majority of our patients had nonischemic cardiomyopathy (NICM). This finding is consistent with prior studies that have shown that BB therapy was more effective on LV remodeling in nonischemic than in ischemic cardiomyopathy.[41] However, the focus of our study was not to compare whether use of BBs is a stronger predictor of reverse remodeling compared with ACEI in different races.

Due its retrospective nature, our study had expected limitations. The number of patients enrolled in this study precluded restriction of analyses to only those with low ejection fraction or only those with symptoms of HF. Those variables that were determined by self-report or review of the medical record are beyond the control of the investigators and thus subject to error. There was also lack of availability of data on clinical outcomes, medical therapy, and lack of information regarding socioeconomic status, including education and income, that may have had an effect on HF outcomes. In addition, this is a single-center study, and the findings may not confer external validity. In our Hispanic population, we did not identify special subgroups such as Mexican-origin Hispanic vs Caribbean-origin Hispanic, which have been shown to have differences in LV remodeling parameters.[38,39] Finally, the methods used in this study serve only to describe statistical associations between variables, which are not necessarily proof of causation.

Conclusion

Our results indicate that among Hispanics, the effects of β-adrenergic blockade and its expected improvement in LV function, LVEDD, and MR, as measures of cardiac remodeling, were not apparent after 1 year of therapy. Furthermore, among HF patients who took BBs for 1 year, there is a high proportion of nonresponders who actually decreased their LVEF significantly, mostly in AAs and Hispanics, regardless of type of cardiomyopathy. An underlying genetic difference might be a potential explanation.

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DOI:10.1002/clc.22164