Impact of Atrial Fibrillation and Heart Failure, Independent of Each Other and in Combination, on Mortality in Community-Dwelling Older Adults

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Atrial fibrillation (AF) and heart failure (HF), common in older adults, are associated with poor outcomes. However, little is known about their impact, independent of each other. We studied 5,673 community-dwelling adults aged ≥65 years in the Cardiovascular Health Study. Baseline prevalent AF and HF were centrally adjudicated, and 116 patients had AF only, 219 had HF only, 39 had both, and 5,263 had neither. The Cox proportional hazards model was used to estimate age-gender-race−adjusted hazard ratio (aHR) and 95% confidence intervals (CIs) for all-cause, cardiovascular (CV), and non-CV mortalities. Participants had a mean age of 73 years (±6 years), 58% were women, and 15% African-American. During 13 years of follow-up, all-cause mortality occurred in 43%, 66%, 74%, and 85% of those with neither, AF only, HF only, and both, respectively. Compared with neither, aHR (95% CIs) for all-cause mortality associated with AF only, HF only, and both was 1.36 (1.08 to 1.72), 2.31 (1.97 to 2.71), and 3.04 (2.15 to 4.29), respectively. Similar associations were observed with CV mortality, but HF only also had greater non-CV mortality (aHR 1.72, 95% CI 1.35 to 2.18). Compared with AF alone, aHR (95% CIs) associated with HF alone for all-cause, CV, and non-CV mortalities was 1.69 (1.29 to 2.23), 1.73 (1.20 to 2.51), and 1.64 (1.09 to 2.46), respectively. Compared with HF alone, those with both conditions had greater CV but not all-cause mortality. In conclusion, community-dwelling older adults with AF have greater mortality than those without but lesser than those with HF, and both conditions were associated with greater CV and all-cause mortalities, whereas only those with HF had greater non-CV mortality. **(Am J Cardiol 2014;114:909−913)**

Both atrial fibrillation (AF) and heart failure (HF) are common in older adults, and both conditions are associated with poor outcomes.[1−4] However, because each is a common morbidity in the other condition, little is known about the effect of one condition independent of the other. There are conflicting data as to whether AF is independently associated with mortality in patients with HF.[5,6] In the present study, we examined interactive impact of AF only, HF only, neither, and both on mortality among community-dwelling older adults.

Methods

We used a public-use copy of the Cardiovascular Health Study (CHS) data obtained from the National Heart, Lung and Blood Institute, which also sponsored the study. The CHS is an ongoing, prospective, community-based, epidemiologic study of cardiovascular (CV) disease risk factors among participants aged ≥65 years, the rationale and design of which have been previously reported.[7] The 5,888 Medicare-eligible CHS participants were recruited in 2 phases (1989 to 1990 and 1992 to 1993) from 4 US counties (Forsyth, North Carolina; Sacramento, California; Washington, Maryland; and Pittsburgh, Pennsylvania). The public-use copy of the CHS data is based on 5,795 participants (93 did not consent to be included in these data).

AF was defined based on baseline electrocardiograms that were confirmed by CHS Events Committee.[8,9] We excluded 158 participants with a history of AF but without electrocardiographic evidence of AF. HF was centrally adjudicated by the CHS Events Committee based on review of medical records for symptoms, signs, medications, and other evidence.[10−17] Data on other characteristics were collected at baseline. Missing values for covariates were imputed based on values predicted by age, gender, and race. Of the 5,673 participants,

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See page 912 for disclosure information.

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Table 1
Baseline characteristics of older adults with atrial fibrillation (AF), heart failure (HF), neither, and both in the Cardiovascular Health Study

Mean (±SD) or n (%)	Neither AF or HF (n = 5263)	AF Only (n = 116)	HF Only (n = 219)	AF and HF (n = 39)	p-Value
Age (years)	73 (±6)	76 (±6)	75 (±6)	76 (±7)	<0.001
Female	3058 (58%)	49 (42%)	115 (53%)	20 (51%)	0.002
Non-white	837 (16%)	11 (10%)	55 (25%)	5 (13%)	0.001
Education college plus	2255 (43%)	49 (42%)	77 (35%)	17 (44%)	0.164
Income >25 K	1944 (37%)	44 (38%)	47 (22%)	10 (26%)	<0.001
Self-reported general health fair to poor	1028 (23%)	36 (31%)	138 (63%)	25 (64%)	<0.001
Smoking (pack years)	17 (±27)	20 (±29)	19 (±29)	17 (±30)	0.486
Alcohol (drinks per week)	3 (±6)	3 (±7)	1 (±5)	1 (±4)	0.005
Medical problems					
Hypertensive	3065 (58%)	69 (60%)	141 (64%)	30 (77%)	0.033
Coronary artery disease	896 (17%)	19 (16%)	143 (65%)	19 (49%)	<0.001
Acute myocardial infarction	413 (8%)	9 (8%)	97 (40%)	8 (21%)	<0.001
Diabetes mellitus	803 (15%)	24 (21%)	70 (32%)	12 (31%)	<0.001
Stroke	197 (4%)	11 (10%)	24 (11%)	8 (21%)	<0.001
Chronic obstructive pulmonary disease	641 (12%)	21 (18%)	43 (20%)	6 (15%)	0.003
Cancer	749 (14%)	20 (17%)	26 (12%)	5 (13%)	0.589
Arthritis	2725 (52%)	130 (49%)	57 (60%)	24 (62%)	0.084
Left ventricular hypertrophy by electrocardiogram	218 (4%)	14 (12%)	29 (13%)	8 (21%)	<0.001
Left ventricular dysfunction by echocardiogram	377 (7%)	22 (19%)	76 (35%)	11 (28%)	<0.001
Clinical parameters					
Systolic blood pressure (mm Hg)	137 (±22)	137 (±21)	136 (±27)	139 (±26)	0.899
Diastolic blood pressure (mm Hg)	71 (±11)	73 (±13)	67 (±12)	68 (±14)	<0.001
Pulse (beats/minute)	68 (±11)	70 (±14)	70 (±13)	74 (±12)	<0.001
Body mass index (kg/m^2)	27 (±4)	27 (±4)	27 (±5)	26 (±5)	0.061
Instrumental activity of daily living	0.3 (±0.7)	0.4 (±0.9)	0.9 (±1.2)	1.2 (±0.2)	<0.001
Time to walk 15 feet (seconds)	6 (±2)	6 (±2)	7 (±3)	8 (±4)	<0.001
Laboratory parameters					
Serum creatinine (mg/dl)	1.0 (±0.4)	1.0 (±0.3)	1.2 (±0.7)	1.0 (±0.4)	<0.001
Hemoglobin (g/dl)	14 (±1)	15 (±1)	14 (±2)	14 (±2)	<0.001
Serum cholesterol (mg/dl)	213 (±39)	190 (±38)	200 (±38)	182 (±35)	<0.001
Serum low density lipoprotein (mg/dl)	131 (±35)	114 (±35)	121 (±34)	108 (±34)	<0.001
Serum high density lipoprotein (mg/dl)	55 (±16)	51 (±15)	50 (±14)	47 (±14)	<0.001
Serum triglyceride (mg/dl)	140 (±76)	123 (±54)	147 (±77)	145 (±99)	0.062
Serum albumin (g/dl)	4 (±0)	4 (±0)	4 (±0)	4 (±0)	0.067
Serum uric acid (mg/dl)	6 (±2)	6 (±2)	7 (±2)	7 (±2)	<0.001
Serum fibrinogen (mg/dl)	323 (±66)	317 (±71)	353 (±78)	337 (±75)	<0.001
Serum interleukin-6 (pg/ml)	2 (±2)	3 (±2)	3 (±2)	3 (±1)	<0.001
Serum coagulation factor-VII (%)	124 (±29)	104 (±24)	119 (±34)	105 (±26)	<0.001
Serum C-reactive protein (mg/dl)	5 (±8)	7 (±16)	8 (±12)	7 (±8)	<0.001
Serum insulin (μIU/ml)	17 (±24)	18 (±14)	27 (±56)	26 (±62)	<0.001

116 had AF only, 219 had HF only, 39 had both, and 5,263 had neither. The primary outcome was all-cause mortality during 13 years of follow-up, which was centrally adjudicated by the CHS Events Committee.[17] Secondary outcomes included CV and non-CV mortalities.

We used the Pearson chi-square test and analysis of variance for categorical and continuous variables, respectively, as appropriate, for descriptive analyses. We then conducted survival analysis and plotted unadjusted Kaplan-Meier curves for all-cause mortality. We then used Cox proportional hazard models to estimate unadjusted, age-gender-race−adjusted, and multivariate-adjusted hazard ratios (aHRs) and 95% confidence intervals (CIs) for all-cause mortality. The multivariate model was adjusted for age, gender, race, smoking, acute myocardial infarction, hypertension, diabetes mellitus, stroke, chronic obstructive pulmonary disease, cancer, arthritis, left ventricular ejection fraction, instrumental activity of daily living, time to walk 15 feet, serum creatinine, and serum C-reactive protein. We repeated the aforementioned process for CV and non-CV mortalities. We then repeated the aforementioned analyses after including those with a history of AF without electrocardiographic evidence. Finally, we then repeated the aforementioned process using AF only and HF only as references. All statistical tests were 2-sided, and tests with p value <0.05 were considered significant. SPSS 22 for Windows (released 2013; IBM Corp, Armonk, New York) was used for data analysis.

Results

Participants (n = 5,673) had a mean (±SD) age of 73 years (±6), 58% were women, and 15% were African-American. Compared with those with neither condition, those with both AF and HF were more likely to be women,