Risk Factors for Atrial Fibrillation in Patients With Normal Versus Dilated Left Atrium (from the Atherosclerosis Risk in Communities Study)

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Epidemiological data are limited regarding risk factors of atrial fibrillation (AF) in patients with normal-sized left atria (LA). We evaluated whether traditional risk factors of AF differ between patients with normal-sized and dilated LA. This is a cross sectional study of community-dwelling participants of the Atherosclerosis Risk in Communities study. LA volume index was measured by 2-dimensional echocardiography. LA volume index ≥ 29 mm^3/m^2 defined dilated LA. Prevalent AF was defined by electrocardiogram and hospital discharge *International Classification of Diseases*-9 codes. Multivariate adjusted logistic regression analysis was used to examine whether magnitude of association of risk factors with AF differ by LA cavity size. Interaction of risk factors by LA cavity size was evaluated to determine significance of these differential associations. Of 5,496 participants (mean age 75 ± 5 years, women 58%), 1,230 participants (22%) had dilated LA. The prevalence of AF was 11% in patients with normal-sized LA and 15% in patients with dilated LA. Age >75 years (odds ratio [OR] 1.87, 95% confidence interval [CI] 1.49 to 2.35, interaction p = 0.12) and heart failure (OR 5.43, 95% CI 3.77 to 7.87, interaction p = 0.10) were stronger risk factors for AF in normal-sized LA than dilated LA. Female gender (OR 1.67, 95% CI 1.01 to 2.77, interaction p = 0.09), weight (OR 1.32, 95% CI 1.02 to 1.71, interaction p = 0.19), and alcohol use (OR 1.61, 95% CI 1.08 to 2.41, interaction p = 0.004) were stronger risk factors for AF in patients with dilated LA than normal-sized LA. In conclusion, risk factors of AF may differ by left ventricular cavity size.   © 2014 Elsevier Inc. All rights reserved. (Am J Cardiol 2014;114:1368−1372)

Atrial fibrillation (AF) is the most common sustained cardiac arrhythmia, and currently affects 2.3 million individuals in the United States.[1] Its prevalence is projected to increase to 5.6 million by 2050.[2,3] Current literature suggests traditional cardiovascular risk factors may lead to dilated left atrial (LA) size which acts as a substrate for AF.[4−6] However, a sizable minority of patients with AF have normal LA.[7] The aims of this study were to investigate traditional AF risk factors in patients with and without dilated LA, and to determine whether the association of these risk factors differs by LA cavity size.

Methods

The Atherosclerosis Risk in Communities (ARIC) study is a community based cohort study that began recruitment in 1987. At baseline, 15,792 participants aged 45 to 64 years were randomly recruited at 4 field centers in the United States (Forsyth County, North Carolina; suburban Minneapolis, Minnesota; Washington County, Maryland; and Jackson, Mississippi). The details of the recruitment and baseline characteristics have been published previously.[8] During the visit-5 examination that was conducted from 2011 to 2013, echocardiography was performed by certified technicians, and LA volume was measured. Thus, this study only includes participants who survived until the fifth examination. For the present analysis, we used the data from 5,496 patients who underwent 2-dimensiontional echocardiography at the field centers during visit 5. Race was dichotomized into white and nonwhite categories for easier interpretation as there were only 15 patients who were nonwhite and nonblack who were added to blacks.

Table 1
Characteristics of the sample stratified by left atrial cavity size

| Characteristics | Left Atrial Cavity Size | | | | | |
| | Increased | | p | Normal | | p |
	AF	No AF		AF	No AF	
Number of patients	188	1042		477	3789	
Age >75 years	122 (65%)	590 (57%)	0.03	304 (64%)	1787 (47%)	<0.0001
Women	96 (51%)	557 (53%)	0.54	244 (51%)	2289 (60%)	0.0001
White race	158 (84%)	791 (76%)	0.01	384 (80%)	2919 (77%)	0.09
Height (cm)	168 ± 10	166 ± 9	0.06	167 ± 10	165 ± 9	0.0003
Weight (kg)	82 ± 20	81 ± 17	0.49	81 ± 17	78 ± 17	0.001
Hypertension	141 (75%)	747 (72%)	0.32	320 (67%)	2257 (60%)	0.0009
Diabetes mellitus	48 (26%)	267 (26%)	0.98	122 (26%)	1128 (30%)	0.06
Current alcohol use	130 (69%)	615 (59%)	0.01	275 (58%)	2317 (61%)	0.13
Current smoking	13 (7%)	48 (5%)	0.17	27 (6%)	220 (6%)	0.92
Exercise >1 day/week	77 (41%)	519 (49%)	0.03	208 (44%)	1886 (50%)	0.02
Coronary artery disease	8 (4%)	26 (2%)	0.18	30 (6%)	76 (2%)	<0.0001
Heart failure	24 (13%)	40 (4%)	<0.0001	63 (13%)	90 (2%)	<0.0001

LA enlargement defined by LA volume index $\geq$29 mm^3/m^2.

AF indicates prevalent AF at visit 5 (2011 to 2013).

Table 2
Differential association of risk factors of atrial fibrillation in individuals with dilated and normal-sized left atrial cavity

| Risk Factors | All Participants* OR (95% CI) | Left Atrial Cavity Size | | Interaction-p |
		Increased OR (95% CI)	Normal OR (95% CI)	
Number of patients	5496	1230	4266	
Age >75 years	1.74 (1.43−2.11)	1.36 (0.93−1.97)	1.87 (1.49−2.35)	0.12
Women	1.20 (0.92−1.57)	1.67 (1.01−2.77)	1.06 (0.77−1.46)	0.09
White race	1.44 (1.13−1.84)	1.37 (0.84−2.23)	1.48 (1.12−1.97)	0.72
Height, per 10 cm	1.27 (1.11−1.46)	1.44 (1.18−1.77)	1.24 (1.05−1.46)	0.48
Weight, per 20 kg	1.09 (0.97−1.23)	1.32 (1.02−1.71)	1.12 (0.98−1.29)	0.19
Hypertension	1.32 (1.08−1.61)	1.31 (0.87−1.98)	1.31 (1.04−1.65)	0.64
Diabetes mellitus	0.97 (0.78−1.20)	1.15 (0.76−1.72)	0.99 (0.77−1.26)	0.20
Alcohol use	0.96 (0.79−1.16)	1.61 (1.08−2.41)	0.81 (0.64−1.01)	0.004
Smoking	1.21 (0.82−1.77)	1.54 (0.75−3.16)	1.13 (0.71−1.78)	0.30
Exercise >1 day/week	0.83 (0.69−1.00)	0.81 (0.56−1.16)	0.82 (0.66−1.02)	0.86
Coronary artery disease	2.17 (1.40−3.37)	1.82 (0.74−4.51)	2.38 (1.44−3.94)	0.35
Heart failure	4.76 (3.51−6.49)	3.62 (2.03−4.50)	5.43 (3.77−7.87)	0.10

* The logistic regression model was adjusted for age >75 years, gender, race, height per 10 cm, weight per 20 kg, hypertension, diabetes, alcohol use, smoking, exercise >1 day/week, coronary artery disease, heart failure, and enlarged status of LA; dilated LA is defined by LA volume index $\geq$29 mm^3/m^2.

Two-dimensional echocardiography was performed and echocardiographic parameters were measured at the core laboratory for ARIC. LA volume index was measured by Simpson's method according to established protocol of the American Society of Echocardiography.[9] We defined LA volume index of $\geq$29 mm^3/m^2 as atrial enlargement.[9,10] Prevalent AF was defined as presence of AF during any of ARIC visits 1 to 5 by either study scheduled electrocardiography or by hospital discharge *International Classification of Diseases*-9 codes 427.3, 427.31, and 427.32 that were obtained by active surveillance of ARIC community hospitals until 2010. Random zero sphygmomanometers were used to measure systolic and diastolic blood pressures with participants in the sitting position after 5 minutes of rest. The average of 2 readings was recorded and hypertension was defined as systolic blood pressure $\geq$140 mm Hg, diastolic blood pressure $\geq$90 mm Hg, or

antihypertensive medication use. Height and weight were measured in light clothing without shoes. Body mass index was calculated as weight in kilograms by the square of height in meters. Diabetes mellitus was defined as fasting blood glucose level $\geq$7.0 mmol/L, nonfasting blood glucose $\geq$11.0 mmol/L, or use of diabetic medication. Alcohol use and smoking status were determined by self-report. Physical activity was defined as frequency of exercise in days per week when exercise was at least 20 minutes of aerobic workout. Coronary artery disease was defined by adjudicated myocardial infarction and coronary heart disease events.[11] Heart failure was identified by hospital discharge *International Classification of Diseases* 9 and 10 codes 428.0, 428.1, 428.2, 428.3, 428.4, and 428.9 and death certificates code I50.0.[12] The coronary artery disease and heart failure events were available until 2010. Blood glucose and uric acid were determined by standard protocols.[13]