Interaction of Blood Pressure and Body Mass Index With Risk of Incident Atrial Fibrillation in a Japanese Urban Cohort: The Suita Study

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BACKGROUND AND PURPOSE
To prevent stroke, strategies for atrial fibrillation (AF) prevention and an early detection of AF by electrocardiogram are essential. However, only a limited prospective studies have examined the risk factors for AF, even in blood pressure (BP) and body mass index (BMI), which are not clear among general populations. We investigated the impacts of BP and BMI on the risk of incident AF in a general population.

METHODS
A total of 6,906 participants (30–84 years) in the Suita Study were prospectively followed up for incident AF. Participants were diagnosed with AF if AF or atrial flutter was present on an electrocardiogram from a routine health examination (every 2 years) or if AF was indicated as a present illness from health examinations and/or medical records during follow-up. Adjusted Cox proportional hazard ratios (HRs) were calculated.

RESULTS
During the 12.8-year follow-up, 253 incident AF events occurred. Compared with the systolic BP (SBP) < 120 mm Hg and normal-weight, the adjusted HRs (95% confidence intervals; CIs) of incident AF in the systolic hypertension and the overweight (BMI ≥ 25 kg/m²) groups were 1.74 (1.22–2.49) and 1.35 (1.01–1.80), respectively. Compared with SBP < 120 mm Hg and normal weight, the adjusted HRs (95% CIs) of incident AF in the SBP = 120–139 mm Hg with overweight and the systolic hypertension with normal or overweight were 1.72 (1.01–2.91), 1.66 (1.10–2.50), and 2.31 (1.47–3.65), respectively (P for interaction = 0.04).

CONCLUSIONS
Systolic prehypertension and overweight are associated with incident AF in Japanese population. The association between SBP and AF may be evident by overweight.

Keywords: atrial fibrillation; blood pressure; body mass index; hypertension; prospective cohort study; risk factor.

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Atrial fibrillation (AF) is the most common chronic arrhythmia and is a risk factor for all-cause mortality1 and stroke.2 To prevent stroke, strategies for AF prevention and an early detection of AF by electrocardiogram are essential. However, only a limited number of prospective studies have examined the risk factors for AF among general populations.

Recent studies have gradually revealed that not only hypertension,3,4 but also prehypertension is a risk factor for incident AF.5,6 Pulse pressure is also a risk factor for incident AF.7 However, it is still difficult to determine which blood pressure (BP) categories associated with incident AF in prospective studies.8 It may be dependent on the different backgrounds of populations, lifestyles, and/or cardiovascular risk factors such as obesity.

Positive associations with incident AF have been observed for overweight9 and class 1,10,11 or 312 obesity. These different results may depend on the different backgrounds of the study populations. The combined impact of obesity and should also be considered regarding the incidence of AF. However, few prospective studies have examined the combined effect of BP and BMI on the incidence of AF in a general population. Only the Women’s Health Study showed no interaction between hypertension and obesity in incident AF.13 Different populations may have different incidence rate of AF,14 and therefore possibly different risk factors for AF. Here, we assessed the hypothesis that the combination of BP and BMI categories increases the risk of incident AF in an urban general Japanese population, which has higher BP and less obesity than Westerners.9

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Original article

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METHODS

Study participants

The design and selection criteria of the Suita Study have already been described. As a baseline, 12,200 and 3,000 participants (aged 30–79 years) were randomly selected from the municipality population registry of Suita city and stratified into groups by sex and age in 10-year increments in 1989 and 1996, respectively. Of these, participants attending the baseline examination of the original cohort \( n = 6,485 \) (1989–1996) and the secondary cohort \( n = 1,329 \) (1996–1998) were eligible for the present investigation. In addition, the baseline examination of a volunteer group \( n = 546, 1992–2006 \) was also included in the present study. Informed consent was obtained from all participants. These evaluations are referred to as the baseline examination for the present investigation. This study was approved by the Institutional Review Board of the National Cerebral and Cardiovascular Center, Suita, Japan.

We excluded participants for the following reasons: prior or current illness of AF or atrial flutter \( n = 42 \) at baseline, missing covariate \( n = 2 \), and failure to complete the baseline examination \( n = 2 \) or the follow-up health surveys \( n = 1,408 \), resulting in a sample of 6,906 participants.

Blood pressure and physical measurement

In National Cerebral and Cardiovascular Center, well-trained physicians measured each participant’s BP 3 times using a mercury column sphygmomanometer, an appropriate-size cuff, and a standard protocol. Before the initial BP reading was obtained, participants were seated at rest for at least 5 minutes. BP values were taken as the average of the second and third measurements, which were recorded more than 1 minute apart. At the time of the baseline examination, each participant was classified into 1 of 3 BP categories (normal BP \(<120/80 \text{ mm Hg}\) ), prehypertension \((120–139/80–89 \text{ mm Hg})\), and hypertension \((\geq 140/90 \text{ mm Hg and/or antihypertensive drug use})\). If the systolic BP (SBP) and diastolic BP (DBP) readings for participants were in different categories, the participants were categorized into the higher of the 2 BP categories. SBP and DBP alone categories were as follows: normal \(<120/80 \text{ mm Hg}\), systolic and diastolic prehypertension \((120–139/80–89 \text{ mm Hg})\), and hypertension \((\geq 140/90 \text{ mm Hg including antihypertensive drug users})\), respectively. Categories of body mass index (BMI), calculated as weight (kg) divided by height (m) squared, were defined by the following criteria: underweight \(<18.5 \text{ kg/m}^2\) , normal weight \((18.5 \text{ to } <25 \text{ kg/m}^2)\), and overweight \((\geq 25 \text{ kg/m}^2)\).

Biochemical measurement and questionnaire

At the baseline examination, we performed routine blood tests that included serum total cholesterol and glucose levels. Hypercholesterolemia was defined as total cholesterol levels \(\geq 5.7 \text{ mmol/L}\) or current use of antihyperlipidemic medications. Diabetes (DM) was defined as fasting serum glucose \(\geq 7.0 \text{ mmol/L}\), nonfasting serum glucose \(\geq 11.1 \text{ mmol/L}\), or medications for DM. Physicians and nurses administered questionnaires covering personal habits and present illness. Past/present illness of stroke included cerebral infarction, intracerebral hemorrhage, and subarachnoid hemorrhage. Past/present illness of heart disease included coronary heart disease, valvular disease, and chronic heart failure. Premature contractions consisted of frequent atrial, junctional, and/or ventricular premature beats (Minnesota Code 8-1-1, 8-1-2, or 8-1-3) without AF/flutter at the baseline. The glomerular filtration rate (mL/min/1.73 m\(^2\) ) of each participant was calculated using the Modification of Diet in Renal Disease equation modified by the Japanese coefficient (0.881), as follows: glomerular filtration rate = 0.881 \( \times \) (serum creatinine\(^{-0.203}\) \( \times \) (age\(^{-0.154}\) \( \times \) (serum creatinine\(^{-0.203}\) \( \times \) (age\(^{-0.154}\) \( \times \)))).

Chronic kidney disease was defined as an estimated glomerular filtration rate \( <60 \text{ mL/min/1.73m}^2\).

Definition of AF and follow-up

Standard 12-lead electrocardiograms were obtained from all participants in the supine position. Each record was coded independently using the Minnesota Code by 2 well-trained physicians. Participants were diagnosed with AF if AF (Minnesota Code 8-3-1) or atrial flutter (Minnesota Code 8-3-2) was present \( n = 170 \) on an electrocardiogram from the routine Suita health check-up examination (every 2 years) or if AF was indicated as a present illness by the health check-up examination \( n = 46 \), and hospital medical records \( n = 33 \), and/or death records \( n = 4 \) during follow-up. The end point of the follow-up period for each participant was whichever of the following options occurred first: (i) the date of the first AF event, (ii) date of the last health examination and medical records, and (iii) May 31, 2013 (ensored).

Statistical analysis

We examined the association between BP or BMI categories and the risk of incident AF using multivariable-adjusted Cox proportional hazard regressions after adjusting for sex and age in 5-year increments as stratified variables, BMI (underweight, normal weight, and overweight) or BP (normal BP, prehypertension, and hypertension), and other potential confounding factors at the baseline survey: namely, hypercholesterolemia, DM, and current smoking and drinking, respectively (Model 1). For Model 2, further confounding variables were used for cohort groups, chronic kidney disease, histories of stroke, coronary heart disease, chronic heart failure, and premature contractions in addition to those in Model 1 (Model 2). The Cox proportional hazard ratios (HRs) and 95% confidence intervals (95% CI) were fitted to the combination of the BP and BMI categories after adjusting for sex and age in 5-year increments as stratified variables and other potential confounding factors. We tested for interactions term generated by SBP \( \times \) BMI strata in the Cox model adjusting for Model 2. We tested for interactions between follow-up year and BP or BMI to determine whether the assumption of proportional hazards for prediction of AF was valid. All analyses were performed with SAS version 9.4 (SAS Institute, Cary, NC).
RESULTS

The baseline characteristics of the study participants grouped according to the SBP and BMI categories are presented in Table 1. At the baseline survey, the participants with systolic hypertension and overweight tend to be older, had higher prevalence of DM and hyperlipidemia, histories of stroke and heart disease, and had a lower frequency of current smoking compared to the participants with normal SBP and underweight, for both men and women. The baseline characteristics according to the 3 cohort groups (original, secondary, and volunteer) are shown in Supplementary Table I, which provides the details of participants’ baseline characteristics.

During the 12.8 years of follow-up, 253 incident AF events occurred. There was no interaction between follow-up year and BP for prediction of AF in the primary Cox model, suggesting that the proportional hazards assumption was appropriate. Compared with the normal ranges of BP categories and pulse pressure <40 mm Hg, the risks of incident AF were increased in the participants with systolic and diastolic hypertension, hypertension, and pulse pressure ≥60 mm Hg, respectively adjusting for age and sex, and Models 1 and 2 (Table 2). Systolic hypertension is a risk factor of AF in men (HR = 1.65 and 95% CI = 1.07–2.56) and women (HR = 1.93 and 95% CI = 1.03–3.65, data not shown). After further adjustment by DBP, a significant association was still observed in systolic hypertension (HR = 1.74 and 95% CI = 1.12–2.69). However, the influences of DBP and pulse pressure were attenuated after adjustment for SBP. When antihypertensive medication users were classified into their BP levels, the risks of AF according to BP categories were similar (Model 2-adjusted HRs and 95% CI in SBP: 1.72 and 1.20–2.48 for systolic hypertension, data not shown).

Compared with the normal weight participants, the adjusted risks of incident AF were increased in the overweight participants after adjustment for age and sex, in Models 1 and 2, and even after adjustment for both SBP and DBP (Table 3).

After adjustment in Model 2, each 1-unit increase in SBP, DBP, pulse pressure, and BMI were associated with increases in the risk of AF. Among BP variables, after the further adjustment by BPs, only SBP was observed to increase the risk of AF (Table 4). The results in men and women separately were weak due to the small sample sizes, but were marginally or statistically significant (Supplementary Table II). After the adjustment by Model 2 plus SBP and DBP, a 5% increased risk of incident AF by 1 kg/m² increase in BMI was revealed.

Compared with SBP < 120 mm Hg and normal weight, the adjusted HRs (95% CIs) of incident AF in the SBP = 120–139 mm Hg participants with overweight and the systolic hypertension participants with normal weight or overweight were 1.72 (1.01–2.91), 1.66 (1.10–2.50), and 2.31 (1.47–3.65), respectively were weak due to the small sample sizes, but were marginally or statistically significant (Supplementary Table II). After the adjustment by Model 2 plus SBP and DBP, a 5% increased risk of incident AF by 1 kg/m² increase in BMI was revealed.

Table 1.Baseline characteristics according to categories of systolic blood pressure and body mass index

<table>
<thead>
<tr>
<th></th>
<th>Systolic BP categories*</th>
<th>Body mass index categories*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal SBP</td>
<td>Systolic prehypertension</td>
</tr>
<tr>
<td>Number, n</td>
<td>2,697</td>
<td>2,201</td>
</tr>
<tr>
<td>Sex (men, %)</td>
<td>42.3</td>
<td>50.7</td>
</tr>
<tr>
<td>Age, year</td>
<td>49.3 ± 12.3</td>
<td>56.9 ± 11.7</td>
</tr>
<tr>
<td>Systolic BP, mm Hg</td>
<td>107.1 ± 7.8</td>
<td>128.8 ± 5.7</td>
</tr>
<tr>
<td>Diastolic BP, mm Hg</td>
<td>69.0 ± 7.8</td>
<td>79.9 ± 8.3</td>
</tr>
<tr>
<td>Body mass index, kg/m²</td>
<td>21.7 ± 2.8</td>
<td>22.8 ± 2.9</td>
</tr>
<tr>
<td>Hypertension, %</td>
<td>0.3</td>
<td>10.9</td>
</tr>
<tr>
<td>Diabetes mellitus, %</td>
<td>2.6</td>
<td>5.0</td>
</tr>
<tr>
<td>Hyperlipidemia, %</td>
<td>28.8</td>
<td>40.5</td>
</tr>
<tr>
<td>Chronic kidney disease, %</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Current smoking, %</td>
<td>31.7</td>
<td>27.9</td>
</tr>
<tr>
<td>Current drinking, %</td>
<td>49.7</td>
<td>53.1</td>
</tr>
<tr>
<td>History of stroke, %</td>
<td>0.4</td>
<td>1.0</td>
</tr>
<tr>
<td>History of heart disease, %</td>
<td>0.7</td>
<td>2.1</td>
</tr>
<tr>
<td>Premature contractions, %</td>
<td>1.6</td>
<td>2.3</td>
</tr>
</tbody>
</table>

Abbreviation: SBP, systolic blood pressure.

*Normal SBP, SBP < 120 mm Hg; systolic prehypertension, SBP = 120–139 mm Hg; systolic hypertension, SBP ≥ 140 mm Hg and/or antihypertensive drug users.

*Body mass index was categorized by the following criteria: underweight, <18.5 kg/m²; normal weight, 18.5 to <25 kg/m²; and overweight, ≥25 kg/m².

*Premature contractions consist of premature atrial and/or ventricular contractions without atrial fibrillation/flutter at the baseline.
respectively (P for interaction between SBP and BMI = 0.04, Figure 1).

DISCUSSION

Our findings indicated that systolic and/or diastolic hypertension, higher pulse pressure, and overweight are risk factors for incident AF. Among these various components of BPs, only systolic hypertension was an independent predictor of incident AF after further adjustment. Overweight also remained a significant factor after further adjustment by both SBP and DBP. Interaction of SBP and BMI with risk of incident AF was observed. Hence, to our knowledge, this is the first positive association on the interaction of SBP and BMI with risk of incident AF in a general population.

In the Women's Health Study, high-normal SBP and DBP were associated with incident AF, and after further adjustment, only systolic hypertension was an independent predictor of incident AF after further adjustment. Overweight also remained a significant factor after further adjustment by both SBP and DBP. Interaction of SBP and BMI with risk of incident AF was observed. Hence, to our knowledge, this is the first positive association on the interaction of SBP and BMI with risk of incident AF in a general population.

Table 2. Multivariable-adjusted hazard ratios (95% confidence intervals) of incident atrial fibrillation according to the various blood pressure categories

<table>
<thead>
<tr>
<th>Blood pressure category</th>
<th>Normal BP</th>
<th>Prehypertension</th>
<th>Hypertension</th>
<th>Trend P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person years</td>
<td>33,751</td>
<td>29,093</td>
<td>25,814</td>
<td></td>
</tr>
<tr>
<td>Cases</td>
<td>50</td>
<td>81</td>
<td>122</td>
<td></td>
</tr>
<tr>
<td>Incidence/1,000 person-year</td>
<td>1.48</td>
<td>2.78</td>
<td>4.73</td>
<td></td>
</tr>
<tr>
<td>Age- and sex-adjusted</td>
<td>1</td>
<td>1.25 (0.87–1.80)</td>
<td>1.70 (1.20–2.40)</td>
<td>0.002</td>
</tr>
<tr>
<td>Model 1 adjusted</td>
<td>1</td>
<td>1.22 (0.84–1.75)</td>
<td>1.58 (1.11–2.26)</td>
<td>0.008</td>
</tr>
<tr>
<td>Model 2 adjusted</td>
<td>1</td>
<td>1.20 (0.83–1.73)</td>
<td>1.53 (1.07–2.19)</td>
<td>0.016</td>
</tr>
</tbody>
</table>

Abbreviations: BP, blood pressure; DBP, diastolic blood pressure; SBP, systolic blood pressure.
Model 1: Adjusted by age, sex, body mass index, hypercholesterolemia and diabetes, current smoking and drinking status.
Model 2: Adjusted by Model 1 factors, cohort groups, chronic kidney disease, and histories of stroke, coronary heart disease, chronic heart failure, and premature contractions.
Impact of BP and BMI on Atrial Fibrillation

Table 3. Multivariable-adjusted hazard ratios (95% confidence intervals) of incident atrial fibrillation according to body mass index categories

<table>
<thead>
<tr>
<th>Body mass index category</th>
<th>Underweight</th>
<th>Normal weight</th>
<th>Overweight</th>
<th>Trend P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person years</td>
<td>6,631</td>
<td>64,641</td>
<td>17,385</td>
<td></td>
</tr>
<tr>
<td>Cases</td>
<td>16</td>
<td>166</td>
<td>71</td>
<td></td>
</tr>
<tr>
<td>Incidence/1,000 person-year</td>
<td>2.41</td>
<td>2.57</td>
<td>4.08</td>
<td></td>
</tr>
<tr>
<td>Age- and sex-adjusted</td>
<td>0.98 (0.58–1.65)</td>
<td>1</td>
<td>1.43 (1.08–1.90)</td>
<td>0.023</td>
</tr>
<tr>
<td>Model 1 adjusted</td>
<td>1.02 (0.61–1.73)</td>
<td>1</td>
<td>1.35 (1.02–1.80)</td>
<td>0.075</td>
</tr>
<tr>
<td>Model 2 adjusted</td>
<td>1.02 (0.60–1.72)</td>
<td>1</td>
<td>1.35 (1.01–1.80)</td>
<td>0.081</td>
</tr>
<tr>
<td>Model 2 and systolic and diastolic BPs adjusted</td>
<td>1.05 (0.62–1.78)</td>
<td>1</td>
<td>1.34 (1.01–1.79)</td>
<td>0.096</td>
</tr>
</tbody>
</table>

Abbreviation: BP, blood pressure.
Model 1: Adjusted by age, sex, normal BP, prehypertension, hypertension, hypercholesterolemia and diabetes, current smoking and drinking status.
Model 2: See Table 2 footnote.

Table 4. Cox proportional hazards models for various types of blood pressure and body mass index as predictors of development of atrial fibrillation

<table>
<thead>
<tr>
<th>Blood pressure component</th>
<th>Units</th>
<th>Age-adjusted HRs (95% CI)</th>
<th>Model 1-adjusted HRs (95% CI)</th>
<th>Model 2-adjusted HRs (95% CI)</th>
<th>Model 3-adjusted HRs (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic BP</td>
<td>per 20 mm Hg</td>
<td>1.25 (1.11–1.39)</td>
<td>1.22 (1.08–1.37)</td>
<td>1.22 (1.08–1.37)</td>
<td>1.24 (1.06–1.47)&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Diastolic BP</td>
<td>per 10 mm Hg</td>
<td>1.15 (1.04–1.28)</td>
<td>1.11 (1.00–1.24)</td>
<td>1.10 (0.99–1.24)</td>
<td>0.97 (0.84–1.12)&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Pulse pressure</td>
<td>per 10 mm Hg</td>
<td>1.13 (1.04–1.22)</td>
<td>1.13 (1.04–1.22)</td>
<td>1.12 (1.04–1.22)</td>
<td>1.03 (0.89–1.19)&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>BMI</td>
<td>per 1 kg/m²</td>
<td>1.27 (1.02–1.11)</td>
<td>1.06 (1.01–1.10)</td>
<td>1.05 (1.01–1.10)</td>
<td>1.05 (1.01–1.10)</td>
</tr>
</tbody>
</table>

Abbreviations: BMI, body mass index; BP, blood pressure; CIs, confidence intervals; HR, hazard ratio.
Model 1: age, sex, (body mass index or BP categories (normal BP, prehypertension, and hypertension)), smoking, drinking, hyperlipidemia, diabetes mellitus, and impaired fasting glucose.
Model 2: See Table 2 footnote.
Model 3: <sup>a</sup>Model 2 and diastolic BP adjustment; <sup>b</sup>Model 2 and systolic BP adjustment.

adjustment of both SBP and DBP, systolic hypertension was still associated with incident AF, but DBP was attenuated, which was similar to the current study. In a healthy Norwegian cohort study in men, the upper-normal SBP (128–138 mm Hg) and DBP (≥80 mm Hg) had 2- and 1.7-folds increased risk of incident AF, however, did not reveal an association between pulse pressure and incident AF.<sup>6</sup>

The Framingham Heart Study showed that a 20-mm Hg increase in pulse pressure was associated with a 1.26-increased risk of AF.<sup>7</sup> SBP was positively associated with AF, but when DBP was added in this model, only pulse pressure still consistent with AF. In our study, high pulse pressure (≥60 mm Hg) and diastolic hypertension were associated with incident AF. However, after further adjustment for SBP, the associations were attenuated. The difference in these results might be due in part to the body composition (mean BMI = 22.5 and 25.7 kg/m² in Japanese and U.S. populations, respectively). Increasing BMI is a strong risk factors for ventricular diastolic dysfunction<sup>19</sup> and increasing pulse pressure.<sup>20</sup> Previous Japanese prospective studies show that SBP is the highest important predictor of incident cardiovascular disease, among the various BP variables, but pulse pressure is less important.<sup>21</sup> Compared with normal BP group, controlled hypertension group does not increased risk of incident AF. However, uncontrolled hypertension is a risk factor for incident AF (HR = 1.53, 95% CI = 1.06–2.21, <sup>13</sup>Supplemental Table III). Controlled hypertension is important to prevent AF. Arterial stiffness, left ventricular hypertrophy, and increased left atrial size are important mediators of the relationship between BP and incident AF.<sup>22</sup>

We found that overweight was linked to a 1.35-fold increased risk of incident AF in this population, and still associated with incident AF after adjustment for both SBP and DBP. In previous cohort studies, the increased risks of incident AF were observed in obese,<sup>11,12,14</sup> and in overweight.<sup>14</sup> The previous cohort studies showed around 4–5% increased risk of each 1-kg/m² increase in BMI<sup>11,12,14</sup> which is compatible with the results of our study. Recently, a Japanese cohort study has shown that obesity was a 2.2-fold increased risk of incident AF<sup>11</sup> but nonassociations with overweight and hypertension were observed. Due to the low frequency of our obese subjects (1.6%), we could not calculate the risk of AF associated with obesity.

Increasing body weight has an important association with left atrial enlargement,<sup>24</sup> because it causes left ventricular hypertrophy<sup>25</sup> and elevated blood flow volume,<sup>26</sup> and increases the vulnerability of the atrium that triggers
The pathogenesis of increasing body weight is related to increasing BP, and involves metabolic dysregulation, the sympathetic nervous system, renin-angiotensin-aldosterone system activity, and renal sodium reabsorption. In the present study, we observed an interaction between BMI and BP for incident AF. Weight gain has previously been associated with left ventricular hypertrophy and an increased risk of hypertension. Participants with both higher SBP and overweight may experience the mutual exacerbation of left ventricular hypertrophy and hypertension, and consequently, a synergistically increased risk of AF.

Our study has several limitations. The primary limitation is a dilution bias; this study was based on a baseline survey of BP and BMI, which may have led to a misclassification of these risk factors for AF. A previous study has suggested, however, that BP measurements taken on a single day are accurate. Second, we did not perform Holter electrocardiography cyclopedically, even if we perform Holter electrocardiography, we may have missed participants with paroxysmal AF. Third, even with the moderate sample size and 12.8-year follow-up, the numbers of incident AF were limited. A study with a larger sample size is required to validate the associations. Fourth, 1,408 participants without follow-up were excluded from our baseline data. Compared with the followed-up subjects, the subjects without follow-up had higher percentage of men and smoking and higher prevalence of hypertension, DM, and hyperlipidemia. However, the prevalence of AF at the baseline was not significant in the 2 groups (Supplemental Table IV). Fifth, we did not use follow-up data of BMI and BP, but baseline data. We can predict the future AF by healthy examinations as a baseline in this study. Near future, we will conduct the different study using updated measures to account for changes in BMI over time frame and to characterize the short-term impact that BMI could have on AF risk, and even how weight-loss and -gain influence on BP level. Finally, we did not have types of antihypertensive agents at the baseline.

In conclusion, hypertension and overweight are important risk factors for incident AF. Interaction of these 2 risk factors with risk of incident AF was observed. For AF prevention, it is important to not have these 2 risks. For early detection of AF, it is also important for a person with those 2 risk factors to take an electrocardiogram regularly.

SUPPLEMENTARY MATERIAL

Supplementary materials are available at American Journal of Hypertension (http://ajh.oxfordjournals.org).

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These two doctors are key person on this study, although they are not coauthors.
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