COMMENT

The roles of electrocardiography and self-screening in the early detection of atrial fibrillation in hypertensive patients

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The incidence of atrial fibrillation (AF) is high among individuals with hypertension, and when hypertension is complicated in patients with AF, the incidence of thromboembolic or cardiovascular events is also high [1, 2]. In the Framingham Study, hypertension was shown to cause a 1.4–1.5-fold higher risk of the development of AF [1], and a meta-analysis identified a similar 1.5-fold risk of AF development when hypertension was present [3]. It is thus expected that the new onset of AF in hypertensive patients can be detected and treated as needed in order to reduce cardiovascular events.

The atrial load is involved in the mechanisms of AF following hypertension, and changes in P-waves are considered to be a reflection of the atrial load [4]. Many investigations—including the Framingham Study and the Atherosclerosis Risk in Communities (ARIC) Study—have demonstrated an association between changes in P-waves and the onset of AF [5], and in this issue, Jagannatha et al. revealed that the P-wave peak time is associated with the new onset of AF in early-onset hypertension [6]. The P-wave peak time is considered a reflection of the left atrial diameter and pressure [7], and it is possible that the P-wave peak time is a reflection of the left atrial load in hypertensive patients. For example, the P-wave terminal force in lead V1 (PTFV1) is a typical finding of the left atrial load, and the P-wave peak time in lead V1 may be prolonged with a left atrial load with greater PTFV1. Further mechanistic investigations of the relationship between the P-wave peak time and the left atrial load are needed.

In the Losartan Intervention for Endpoint reduction in hypertension (LIFE) Study, the angiotensin II receptor blocker (ARB) losartan improved the patients' prognoses compared to beta-blockers, and a regression of electrocardiographic left ventricular hypertrophy was associated with the improved prognoses [8]. Just as the Cornell product and Sokolow-Lyon criteria are now used as surrogate markers of organ damage in hypertensive patients, changes in P-waves may play a similar role. Although left ventricular hypertrophy findings on electrocardiography (ECG) have also been shown to be associated with blood pressure (BP) levels, we demonstrated that P-wave prolongation was associated with higher office BP levels [9]. In the future, the question of whether P-wave abnormalities can be used as an effective indicator of hypertensive organ damage will require two axes, with research examining (1) how P-wave abnormalities are related to cardiovascular events, and (2) the mechanisms by which P-wave abnormalities cause an excessive atrial load, including the use of invasive methods and basic studies.

Gawałko et al. described a protocol for AF detection in hypertensive patients, including detection by home BP monitoring [10], and we are developing an algorithm for AF detection with home BP monitoring and other methods [11–13]. However, home BP monitoring is not primarily for the early detection of AF; it is conducted for appropriate BP management. High BP levels was also associated with a risk for the development of AF, with a 1.18–1.20-fold higher risk of developing AF per 20 mmHg of systolic BP and a 1.05–1.07-fold risk per 10 mmHg of diastolic BP [3]. Blood pressure control with the use home BP monitoring may help prevent AF and cardiovascular events after the development of AF. In addition, in the All Nippon AF in the Elderly (ANAFIE) Registry of elderly Japanese patients with AF, home BP was poorly controlled [14] and high home systolic BP (≥145 mmHg) was associated with a risk of stroke/ bleeding events [15]. Adequate BP control with a home BP

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STEP 1: Screening/risk stratification

High risk for cardiovascular events
Hypertension, diabetes, hyperlipidemia, age ≥65 years, coronary artery disease, heart failure, sleep apnea syndrome, chronic obstructive pulmonary disease, etc.

STEP 2: Detection of IHB

Regular ECG checks	**Self-screening of AF (IHB)**			
High-risk ECG change * If AF, go to STEP 4	Home BP monitor (IHB monitoring)	Self pulse check	Smartwatch	PPG monitoring
Hypertensive organ damage				
P-wave change, LAE, LVH	Uncontrolled BP			

STEP 3: Diagnosis of AF

Several seconds >>>	**24 hr** >>>	**several days — several weeks**
12-lead ECG	Holter ECG	Long term recording ECG

STEP 4: Treatment

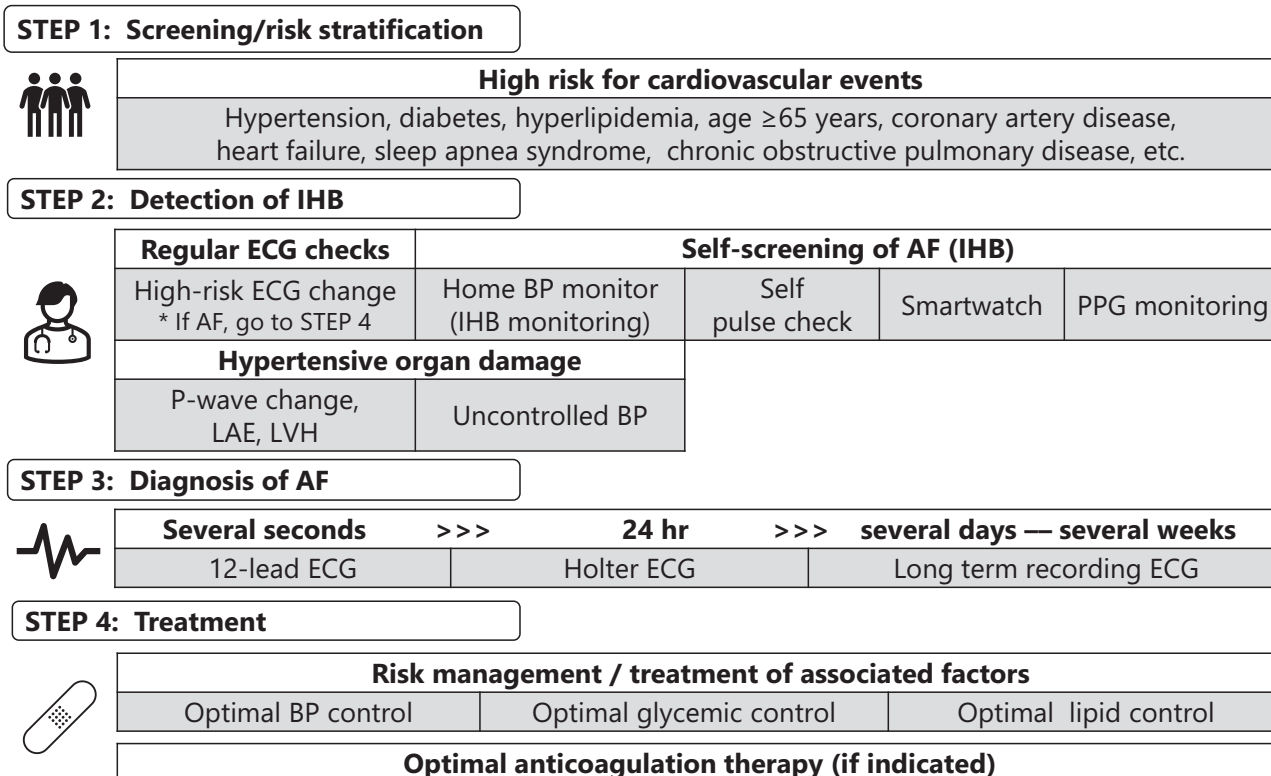| **Risk management / treatment of associated factors**		
Optimal BP control	Optimal glycemic control	Optimal lipid control
Optimal anticoagulation therapy (if indicated)		

Fig. 1 The combination of electrocardiography (ECG) and home blood pressure (BP) monitoring for the early detection and management of atrial fibrillation (AF) in patients at high risk for cardiovascular events. IHB irregular heart beat, LAE left atrial enlargement, LVH left ventricular hypertrophy, PPG photoplethysmography

monitor may reduce the risk of bleeding if anticoagulation therapy will be needed.

The combination of ECG and home BP monitoring for the early detection and management of AF in patients at high risk for cardiovascular events is illustrated in the Fig. 1. First, high-risk patients for cardiovascular events are screened for early detection of AF (Step 1), and the ECG and self-screening for AF are performed (Step 2). If the self-screening for AF reveals an irregular heart beat, a definitive diagnosis of AF is made by ECG. In addition to an examination by Holter ECG, the readings by an ECG system that are recorded over a longer period increase the detection rate of paroxysmal AF (Step 3). Once AF is detected, the appropriate management of associated factors can be considered [16], and if indicated, anticoagulation therapy should be administered (Step 4). If there are findings of hypertensive organ damage on the ECG, the patient's BP levels should be checked and appropriate BP control should be performed.

In the future, devices for AF detection will continue to evolve, and the diagnostic algorithms and management flows of AF will change. However, we believe that the need for optimal home BP control and ECG examinations for the prevention of cardiovascular events will not change.

Compliance with ethical standards

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