

# Atrial Fibrillation and Paroxysmal Atrial Fibrillation Detection in Patients with Acute Ischemic Stroke

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*Background:* Studies about continuous electrocardiographic (ECG) monitoring in detection of paroxysmal atrial fibrillation (PAF) in Asian patients with acute ischemic stroke are very limited. We looked for the prevalence and associated factors of atrial fibrillation (AF) and PAF in Thai patients with acute ischemic stroke. *Methods:* In all, 204 patients with acute ischemic stroke were prospectively included. Snapshot 12-lead ECG and continuous ECG monitoring for at least the first 24 hours were performed. Multivariate analyses were performed to find out the associated factors of AF and PAF. *Results:* AF was diagnosed in 31 patients (15%) and PAF in 15 patients (7%). Twelve and 3 patients with PAF were diagnosed by continuous ECG monitoring and snapshot 12-lead ECG, respectively. Mean duration of continuous ECG monitoring and mean time to detect PAF were 55 and 23 hours, respectively. Multivariate analysis revealed that age of 70 years or older (odds ratio [OR] 3.52, 95% confidence interval [CI] 1.68-7.35,  $P = .001$ ) and heart diseases (OR 4.26, 95% CI 1.14-15.95,  $P = .031$ ) were associated with AF and PAF. *Conclusions:* AF/PAF was one of the common causes of ischemic stroke in Thai patients. Most PAF was detected by continuous ECG monitoring. Snapshot 12-lead ECG and continuous ECG monitoring should be recommended in all patients with acute ischemic stroke. **Key Words:** Paroxysmal atrial fibrillation—atrial fibrillation—stroke—Asian—Thai.

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## Introduction

Cardioembolic stroke accounts for one fourth to one third of all ischemic stroke. Atrial fibrillation (AF), the prevalence of which increases with aging, is the most common cause of cardioembolic stroke.<sup>1,2</sup> A clinical

cardiovascular examination and a 12-lead electrocardiogram (ECG) are recommended to be performed in all stroke patients, and cardiac monitoring is useful and should be conducted routinely after acute stroke to screen for serious cardiac arrhythmia.<sup>3</sup>

Paroxysmal atrial fibrillation (PAF) is associated with a comparable increase in risk of ischemic stroke as permanent AF.<sup>4</sup> Noninvasive cardiac monitoring methods, such as Holter monitoring and continuous cardiac telemetry, were developed aiming to detect PAF. However, which method is the best method and the recommended duration of monitoring in patients with acute ischemic stroke are still debated. From previous reviews, Holter monitoring for 24-48 hours can identify AF in 1%-5% of patients undetected by initial ECG. Extended duration of monitoring and confining its use to patients with nonlacunar stroke may improve detection rates.<sup>5,6</sup> With the approved new anticoagulants, secondary prevention of recurrent thromboembolic events was at least equally or even more effective, with less bleeding complications

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than previous vitamin K antagonist therapy. Thus, it may be worthwhile to detect PAF.

Stroke was the second cause of mortality worldwide in 1990 with two thirds of these deaths occurring in less developed countries.<sup>7</sup> Because of the limited number of stroke experts and resources, it is not possible to perform all the recommended investigations and managements in many parts of these countries. A multicenter countrywide prospective cohort study aiming to evaluate quality of acute stroke care in Thailand showed that only 52% and 3.4% of patients with acute ischemic stroke were admitted to acute stroke units in the university hospitals and community hospitals, respectively.<sup>8</sup> Continuous ECG monitoring is usually performed in stroke units. Thus, only a portion of Thai patients with acute ischemic stroke had early, continuous ECG monitoring. Most studies in PAF detection come from Western countries. Studies about continuous ECG monitoring in Asian patients with acute ischemic stroke are very limited. In this study, we looked for the prevalence and associated factors of AF and PAF that were diagnosed by snapshot ECG and continuous ECG monitoring in Thai patients with acute ischemic stroke.

**Methods**

Patients with acute ischemic stroke who were treated at Thammasat University Hospital during May 2012-October 2012 were prospectively included. Snapshot 12-lead ECG was performed as soon as possible at the emergency room. After admission to the stroke unit, all patients were “hooked up” with the continuous ECG monitoring for at least the first 24 hours, unless the patients were removed from the stroke unit for other investigations, such as carotid duplex, or having physical therapy. Lead 2 ECG was continuously displayed at overhead monitor at bedside and also at a central monitor at the nurse station. If there were any abnormalities on the ECG tracing while monitoring, another snapshot 12-lead ECG was performed at bedside. All stroke nurses and neurologic residents were trained to detect any abnormalities in the ECG. All abnormal ECG records were reviewed later by a cardiologist, blinded to clinical data of the patients.

Baseline characteristics of the patients, underlying cardiovascular risk factors, coronary artery disease, other heart diseases (such as valvular heart diseases, cardiomyopathy), severity of the stroke, ECG findings, duration of continuous ECG monitoring, and duration of PAF detection were studied. Severity of stroke was evaluated by the National Institutes of Health Stroke Scale. Favorable outcome at discharge was defined by having modified Rankin scale 0-2 at discharge. The demographics and vascular risk factors were compared between patients with and without AF/PAF using Student *t* test (for the continuous variables) and the chi-square test (for the

**Table 1.** Baseline characteristics of patients in the study

Baseline characteristics	Total number, 204 patients
Mean age (y) (range)	63 (16-93)
Mean NIHSS (range)	9 (0-28)
Female, n (%)	85 (42%)
Hypertension, n (%)	142 (70%)
Diabetes mellitus, n (%)	61 (30%)
Hyperlipidemia, n (%)	140 (69%)
Coronary artery disease, n (%)	23 (11%)
Old ischemic stroke, n (%)	21 (10%)
Old intracerebral hemorrhage, n (%)	3 (1.5%)
History of transient ischemic attack, n (%)	3 (1.5%)
Smoking, n (%)	59 (29%)
Hyperthyroid, n (%)	1 (.5%)
Intravenous thrombolytic treatment, n (%)	60 (29%)

Abbreviation: NIHSS, National Institutes of Health Stroke Scale.

proportions). The multivariate analyses were performed by including the prespecified factors that were associated with AF and PAF in the univariate analysis. The study was approved by the Faculty of Medicine, Thammasat University’s ethical review committee.

**Results**

In total, 204 patients were included. Baseline characteristics of the patients are presented in Table 1. Mean age of the patients was 63 with the mean National Institutes of Health Stroke Scale score of 9. AF and PAF were diagnosed in 31 patients (15%) and 15 patients (7%), respectively. In the subgroup of patients with AF, 14 patients (6.9%) had known AF and 17 patients were newly diagnosed. Snapshot 12-lead ECG was able to detect AF in all 31 patients. In subgroup of patients with PAF, 3 patients were diagnosed by snapshot 12-lead ECG and the rest (12 patients) by continuous ECG monitoring. PAF was detected within 24 hours of ECG monitoring in 11 patients. Mean and median duration of continuous ECG monitoring were 55 and 38 hours. Mean and median times to detect PAF were 23 and 16 hours (Fig 1). Duration of PAF ranged from 10 seconds to 87 hours. Besides AF/PAF, acute myocardial infarction was diagnosed in 6 patients, and other arrhythmias, including bradycardia, Mobitz type 1, first-degree atrioventricular block, supraventricular tachycardia, and frequent premature ventricular contraction, were diagnosed in 9 patients while having either snapshot 12-lead ECG or continuous ECG monitoring.

Patients with AF/PAF were older, a greater proportion was female, and a greater proportion had heart diseases (Table 2). Multivariate analysis revealed that age of 70 years or older (odds ratio [OR] 3.52, 95% confidence

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