Peri–coronary sinus atrial flutter associated with prior slow pathway ablation

Mitsunori Maruyama, MD, PhD, FHRS,* Shunsuke Uetake, MD, PhD,*
Yasushi Miyauchi, MD, PhD, FHRS,* Yoshihiko Seino, MD, PhD,* Wataru Shimizu, MD, PhD†

*From the *Department of Cardiovascular Medicine, Nippon Medical School Chiba Hokusoh Hospital, Chiba, Japan, and †Department of Cardiovascular Medicine, Nippon Medical School, Tokyo, Japan.*

Introduction

A human anatomic study has shown that a cuff of striated muscle consistently surrounds the venous wall of the coronary sinus (CS) and is connected to the left atrium (LA) by muscular bundles in a variable fashion.[1] The presence of electrical connections between the CS musculature and LA myocardium provides a potential anatomic substrate for reentry. In fact, atypical atrial flutter (AFL) involving the CS musculature in its reentrant circuits has been reported,[2,3] and some studies have suggested that reentry via the CS–LA electrical connections could contribute to the initiation and maintenance of atrial fibrillation.[4,5]

Here, we describe a patient with a unique form of atypical AFL with a reentrant circuit utilizing the CS musculature and myocardium adjacent to the CS that occurred as an iatrogenic tachyarrhythmia following prior ablation of atrioventricular nodal reentrant tachycardia (AVNRT).

Case report

A 66-year-old man presented to our hospital, complaining of a 2-month history of palpitations and easy fatigability. At the age of 62, he had undergone slow pathway ablation for the slow-fast form of AVNRT in our department. In the previous session, radiofrequency (RF) energy was applied 3 times at the proximal CS up to 1 cm inside from the CS ostium, because RF ablation at the right inferoseptum had been ineffective. However, those ablation attempts in the CS failed and a successful ablation finally was accomplished at the superior aspect of Koch's triangle. On a 12-lead surface electrocardiogram, he now presented with AFL with sawtooth-like flutter

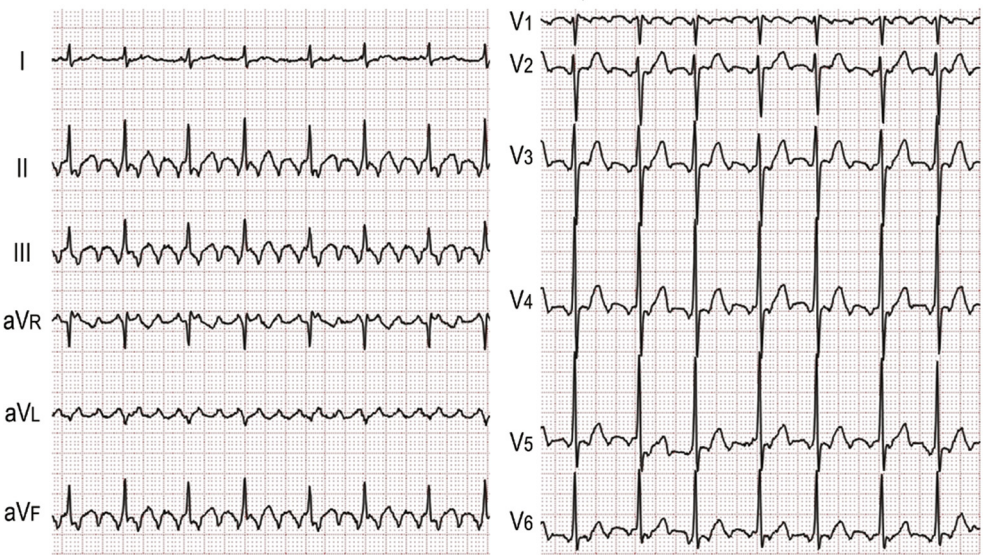

Figure 1 Surface 12-lead electrocardiogram showing atrial flutter (AFL) with 3:1 atrioventricular conduction. Sawtooth-like negative flutter waves were noted in the inferior leads. The negative flutter waves in all precordial leads were not compatible with typical AFL.

KEYWORDS Ablation; Atrial flutter; Coronary sinus; Reentry
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Address reprint requests and correspondence: Dr Mitsunori Maruyama, Department of Cardiovascular Medicine, Nippon Medical School Chiba Hokusoh Hospital, 1715 Kamakari, Inzai-city, Chiba 2701694, Japan. E-mail address: maru@nms.ac.jp.

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KEY TEACHING POINTS

- Peri–coronary sinus (CS) atrial flutter utilizing the CS musculature, adjacent left atrial (LA) myocardium, and CS–LA bridging muscular bundles can occur secondary to radiofrequency ablation within the CS.
- A disparate CS activation pattern may indicate the peri-CS atrial flutter.
- A critical slow conduction site in the CS associated with the prior ablation should be an ablation target for the peri-CS atrial flutter.

waves at a cycle length of 200 ms (Figure 1). The flutter waves were negative in the inferior leads and all precordial leads. A 24-hour Holter monitoring revealed that the AFL persisted throughout the day of monitoring. The transthoracic echocardiography was normal except for a slightly enlarged LA.

In an electrophysiological study, the AFL incidentally terminated when we attempted to insert a multielectrode catheter (6-mm interelectrode spacing for the CS; Japan Lifeline, Tokyo, Japan) into the CS. Atrial burst pacing during isoproterenol infusion induced nonclinical AFL (AFL #1). AFL #1 had the same cycle length and different morphologies when compared to the clinical AFL. During AFL #1, double potentials with decreasing interpotential intervals from the proximal to distal CS were noted (Figure 2A, upper). The early components had a high amplitude and frequency that seemed to represent local potentials from the CS musculature, whereas the late components had a low amplitude and frequency, indicating far-field LA potentials. Although the difference between the postpacing interval and tachycardia cycle length (PPI-TCL) at the cavotricuspid isthmus (CTI) was <20 ms, creation of a CTI conduction block did not affect AFL #1. We constructed biatrial activation maps during AFL #1 with an electroanatomic mapping system (EnSite

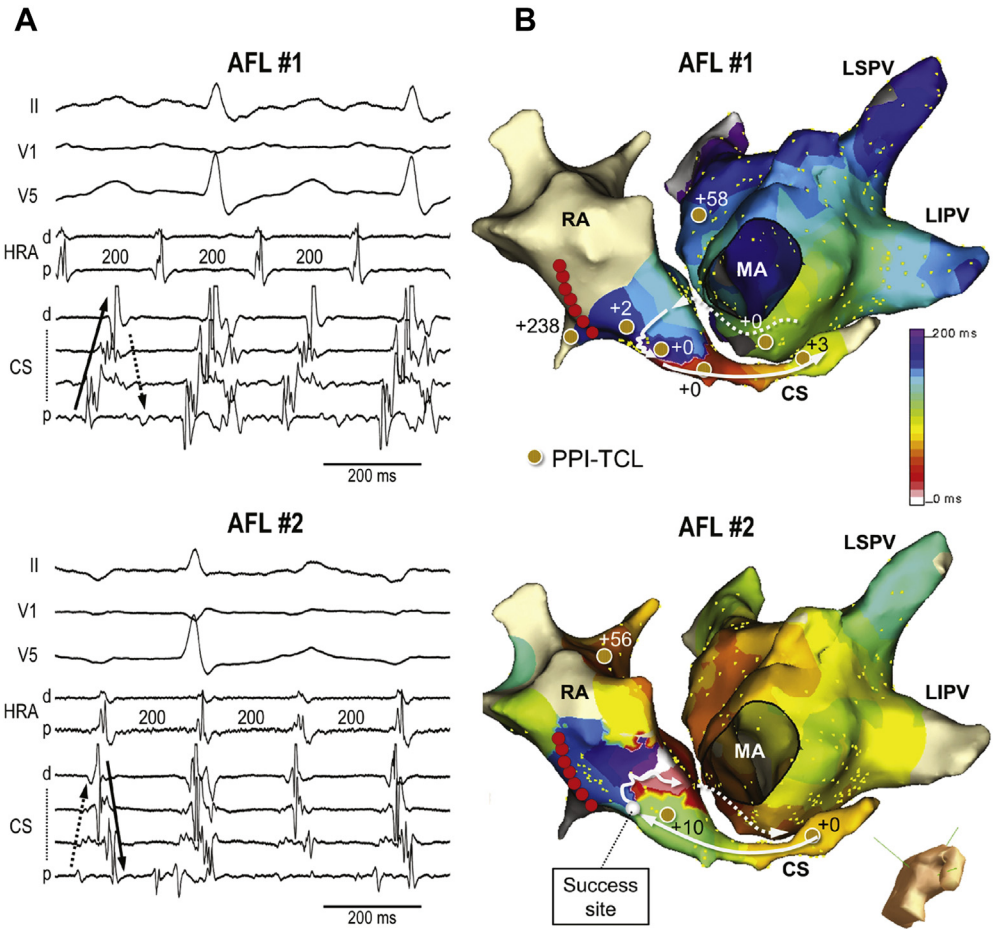

Figure 2 **A:** Surface electrocardiogram and intracardiac electrograms from the high right atrium (HRA) and coronary sinus (CS) during induced (AFL #1) and clinical (AFL #2) atrial flutter (AFL). The CS disparate activation pattern was observed both in AFL #1 and AFL #2, but the direction of the CS musculature (*arrows*) and left atrium (LA; *dotted arrows*) activations was the opposite between AFL #1 and AFL #2. **B:** Activation maps of the right atrium (RA) and LA during AFL #1 and AFL #2. Note the counterclockwise and clockwise activations around the CS area in AFL #1 and AFL #2, respectively. A conduction block line across the cavotricuspid isthmus is shown by the red tags. A partial conduction block with slow conduction was noted in the proximal CS. LSPV = left superior pulmonary vein; LIPV = left inferior pulmonary vein; MA = mitral annulus; PPI–TCL = difference between the postpacing interval and tachycardia cycle length.