

# Efficacy of amiodarone in a case with pre-excited atrial fibrillation with a precarious conduction property of the accessory pathway



Haruhiro Takahira, MD,\* Kazuo Miyazawa, MD, PhD,\* Takatsugu Kajiyama, MD, PhD,\* Masahiro Nakano, MD, PhD,† Yusuke Kondo, MD, PhD,† Yoshio Kobayashi, MD, PhD\*

From the \*Department of Cardiovascular Medicine, Chiba University Graduate School of Medicine, Chiba, Japan, and †Department of Advanced Cardiorhythm Therapeutics, Chiba University Graduate School of Medicine, Chiba, Japan.

## Introduction

The use of amiodarone for pre-excited atrial fibrillation (AF) with Wolff-Parkinson-White (WPW) syndrome has been reported to lead to spontaneous ventricular fibrillation. We hereby report a case in which amiodarone was effective for this arrhythmia.

## Case report

A 66-year-old man with a history of angina pectoris presented with shortness of breath and palpitation. He had been previously diagnosed with WPW syndrome and AF but had no overt symptoms. On examination, it was revealed that he had hypoxia and edema with a high ventricular rate of 178 beats per minute (bpm). The 12-lead electrocardiogram (ECG) showed AF with intermittent ventricular pre-excitation in which the QRS width varied from 120 to 150 ms (Figure 1). The shortest R-R interval on the ECG during wide QRS tachycardia was relatively long (approximately 380 ms). For further assessment and treatment, the patient was transferred to our hospital. As he had pulmonary congestion and left ventricular (LV) systolic dysfunction with an ejection fraction of 26%, he was diagnosed with heart failure complicated by AF tachycardia. Despite initial treatment for heart failure, including the infusion of a diuretic, heart failure did not improve and the high ventricular rate was sustained. Moreover, cardioversion was not performed because a thrombus in the left atrium (LA) was detected by transesophageal echocardiography; thus, anticoagulation therapy

## KEY TEACHING POINTS

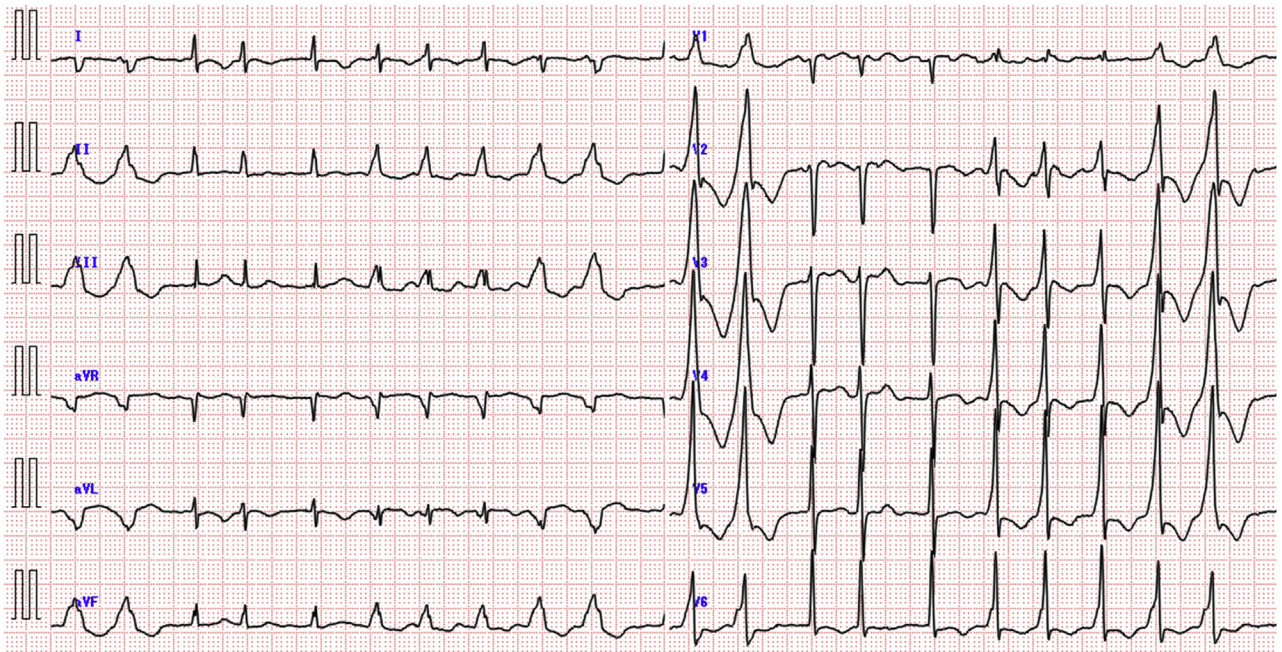
- Pharmacological management of pre-excited atrial fibrillation for an impaired ventricular function is challenging, but amiodarone can be a candidate.
- Because amiodarone is a unique multichannel blocker, it potentially affects the atrioventricular nodal conduction rather than the accessory pathway conduction; therefore, the current guidelines do not recommend its use.
- Estimation of the effective refractory period of the accessory pathway is important to avoid any possible ventricular fibrillation during the use of amiodarone.

was initiated. Class 1A and 1C antiarrhythmic drugs were contraindicated owing to their negative inotropic effect on LV systolic function. Therefore, amiodarone was administered intravenously (bolus of 125 mg over 10 minutes, 300 mg over 6 hours, and continuous intravenous injection of 450 mg over 18 hours). Consequently, the heart rate gradually decreased to 80 bpm without ventricular pre-excitation on the ECG (Figure 2), and heart failure improved. The administration of amiodarone was switched from continuous intravenous injection to oral administration, 14 days after it was started. After discharge, the patient was readmitted for an electrophysiological study. After we confirmed the absence of thrombus in the LA, sinus rhythm was restored by cardioversion under propofol administration. Antegrade/retrograde conduction, via the accessory pathway (AcP), was recorded at the left anterior wall of the mitral annulus (Figure 3). The effective refractory period (ERP) of the antegrade conduction of the AcP was more than 900 ms. However, the effective refractory period of the atrioventricular (AV) node was less than 450 ms. Radiofrequency energy was applied to the AcP using a transeptal approach with an

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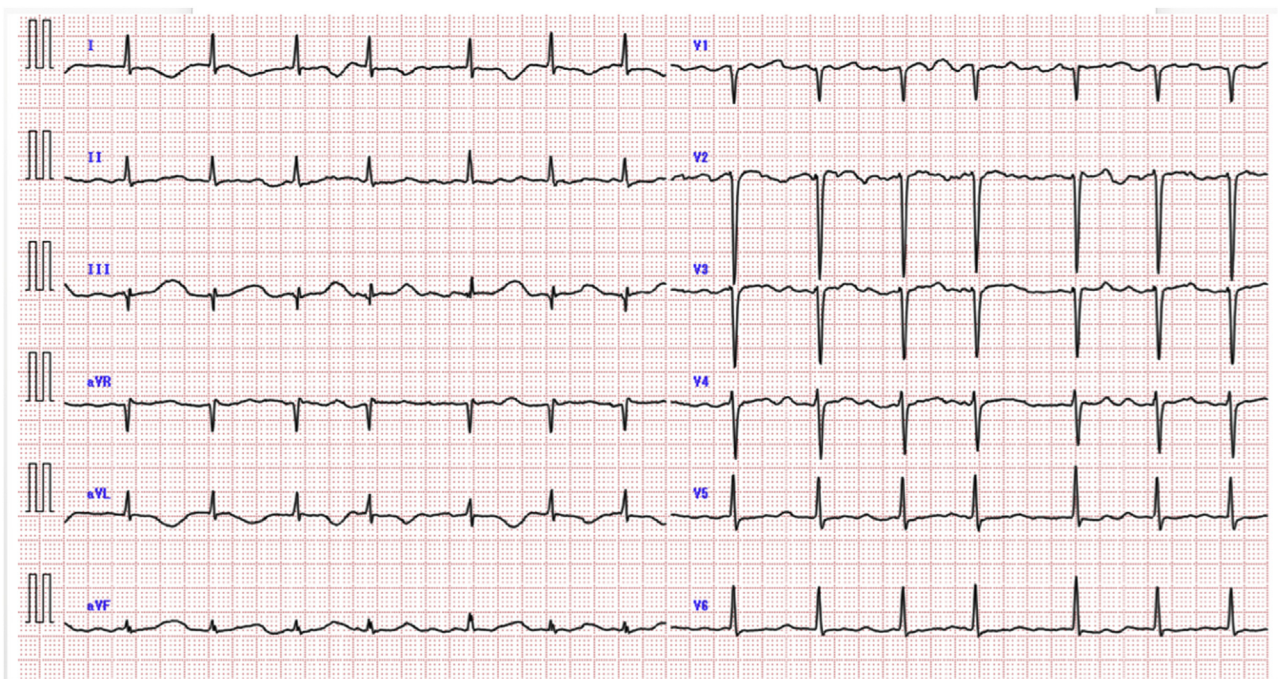


**Figure 1** A 12-lead electrocardiogram exhibiting an atrial fibrillation tachycardia of 138 beats per minute with intermittent wide QRS complexes and a variable QRS width.

irrigated ablation catheter. The AcP conduction was transiently eliminated at the site and additional radiofrequency application at the vicinity of the AcP successfully achieved a complete conduction block. Thereafter, the 12-lead ECG displayed no ventricular pre-excitation and echocardiography showed improved LV systolic function with an LV ejection fraction of 60%.

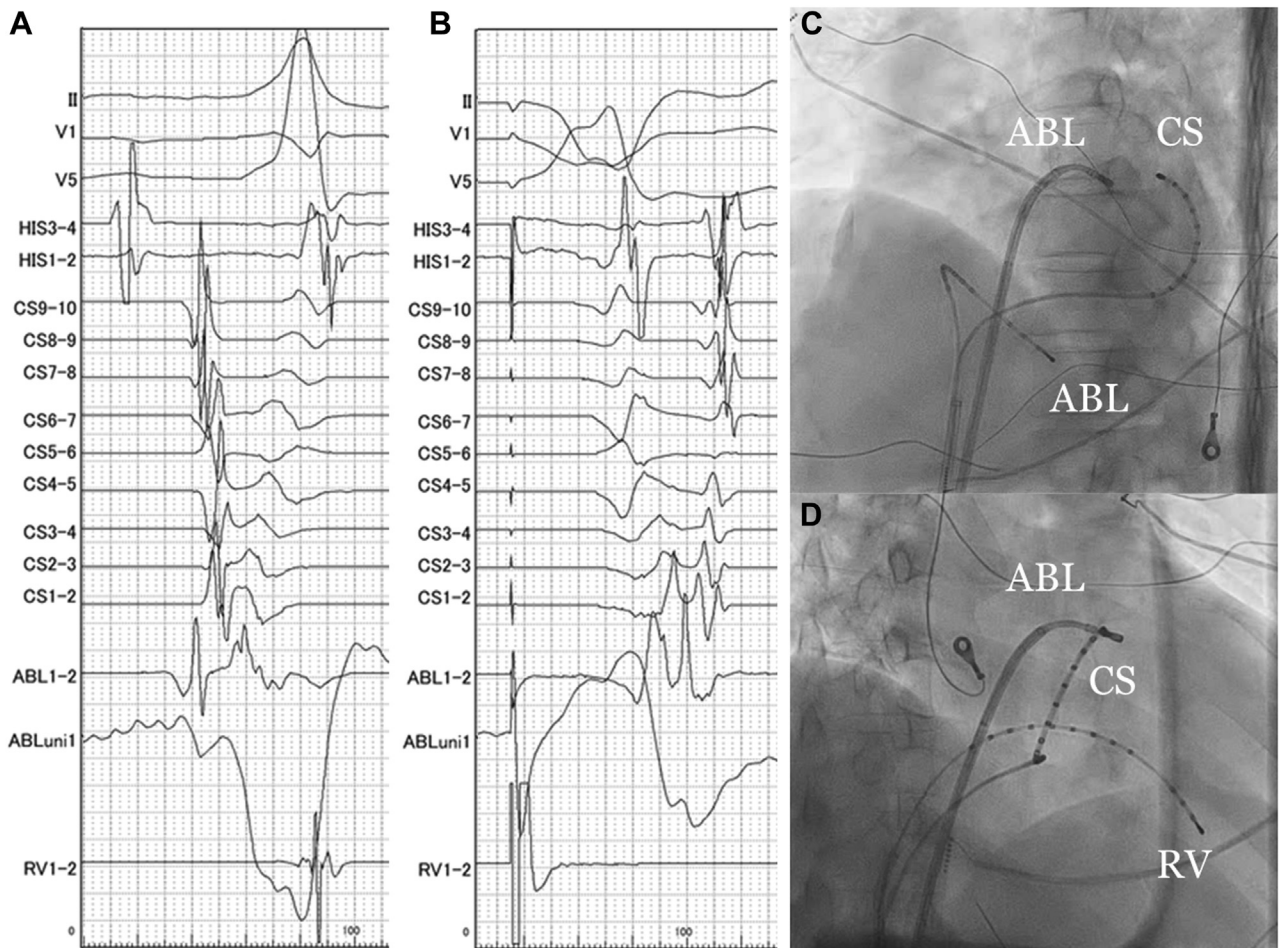
## Discussion

In patients with WPW syndrome, AF presents with a rapid ventricular response and wide QRS complex on an ECG, reflecting dominant conduction via the AcP, which has a shorter refractory period than AV node conduction. The fast conduction of an atrial high-frequency impulse potentially degenerates into a life-threatening arrhythmia,



**Figure 2** A 12-lead electrocardiogram exhibiting atrial fibrillation without ventricular pre-excitation after amiodarone administration.





**Figure 3** A,B: An intracardiac electrogram during sinus rhythm (A) and right ventricular apical pacing (B). C,D: A fluoroscopic image during the electrophysiological study (C: left oblique view, D: right oblique view). ABL = ablation catheter; CS = coronary sinus; RV = right ventricle.

such as ventricular fibrillation, and can lead to cardiac arrest.<sup>1</sup> The current clinical guidelines recommend the use of class IA and IC antiarrhythmic drugs as pharmacological therapies for pre-excited AF,<sup>2</sup> whereas amiodarone is considered to be potentially harmful to patients with pre-excited AF based on a previous case report, which describes hemodynamic instability due to the acceleration of the ventricular response after intravenous administration of amiodarone.<sup>3</sup> Amiodarone has a wide spectrum of multichannel pharmacological effects, including not only potassium and sodium channel blockade to lengthen the antegrade refractory periods of AcP, but also calcium channel blockade to affect AV node conduction.<sup>4</sup> It is known that the effects of amiodarone in the acute phase enhance the inhibition of inward sodium and calcium currents, whereas voltage- and ligand-gated potassium channel currents are decreased with oral administration in the chronic phase.<sup>5</sup> Furthermore, intravenous amiodarone administration may have a more prevalent effect on AV node conduction than on AcP conduction.<sup>3</sup> Intravenous amiodarone administration has calcium channel-blocking activity, which has a rate-dependent effect on AV node conduction (the greater the effect, the more rapid the rate, such as AF conduction).<sup>6</sup> Furthermore, the

antiadrenergic effect of amiodarone is synergistic with calcium channel blockade in the depression of AV node conduction.<sup>7</sup>

In our case, class IA and IC antiarrhythmic drugs were contraindicated owing to their negative effect on LV systolic function, and electrical cardioversion was not performed owing to a thrombus in the LA. Therefore, we administered amiodarone intravenously, which was effective in the control of the ventricular rate and treatment of heart failure by slowing both AcP and AV node conduction, in contrast to the observations in previous case reports. This may have been because our case presented with a relatively long ERP of antegrade conduction via the AcP. A previous study demonstrated that the pharmacological prolongation of the ERP of AcP by amiodarone is more frequently achieved in patients with an initial ERP of AcP  $\geq 270$  ms than in those with a shorter ERP.<sup>8</sup> In fact, the initial ECG in our case showed AF tachycardia with intermittently wide QRS complexes. Furthermore, in our study, the shortest R-R interval during wide QRS tachycardia was relatively long. As a result of the continued administration of amiodarone, the ERP of the antegrade conduction of the AcP was prolonged further. Thus, the antegrade conduction of the AcP possessed a

precarious and long ERP property, which may have reflected predominant effect of amiodarone on the AcP over the AV node conduction. Although it may be possible that exhaustion/fatigue phenomenon of the AcP conduction led to narrowing of the QRS complex and the decrease in the ventricular rate after administration of amiodarone, the phenomenon could not be confirmed during electrophysiological study owing to substantially depressed conduction via the AcP by orally administered amiodarone.

In conclusion, the presented case indicates that amiodarone is a considerable therapeutic option in some patients with pre-excited AF. The initial value of the ERP of the AcP might be useful to estimate whether the administration of amiodarone is effective in patients with pre-excited AF.

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