Safety Concern with Electrical Cardioversion of Persistent Atrial Fibrillation with Slow Ventricular Response

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Abstract

Rhythm control strategies in patients with atrial fibrillation (AF) can bring many clinical benefits. However, there is still uncertainty regarding selection of the optimal rhythm control strategy for persistent AF. Chronicity, substrate alteration, and underlying bradyarrhythmias could influence the clinical outcomes. Current guidelines do not provide a distinct recommendation for electrical cardioversion in patients with AF with a slow ventricular response (SVR). We present two cases of sudden cardiac arrest due to sustained ventricular tachycardia/fibrillation after electrical cardioversion of persistent AF with SVR.

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Rhythm control strategies in patients with atrial fibrillation (AF) can bring many clinical benefits. However, there is still uncertainty regarding selection of the optimal rhythm control strategy for persistent AF. Chronicity, substrate alteration, and underlying bradyarrhythmias could influence the clinical outcomes. Current guidelines do not provide a distinct recommendation for electrical cardioversion in patients with AF with a slow ventricular response (SVR). We present two cases of sudden cardiac arrest due to sustained ventricular tachycardia/fibrillation after electrical cardioversion of persistent AF with SVR.

Keywords

atrial fibrillation, bradycardia, electric countershock, sudden cardiac death, artificial pacemaker

Introduction

Atrial fibrillation (AF) is the most common arrhythmia, and the incidence and prevalence are increasing.[1] Recently, the benefits of rhythm control strategies in AF patients has been spotlighted to a greater extent.[2] For successful rhythm control and prevention of complications, appropriate patient selection is essential. In particular, the rhythm control strategy in AF patients with slow ventricular response (SVR), who might have underlying sick-sinus syndrome (SSS) or atrioventricular (AV) conduction disturbance, requires greater attention. In these patients, pacemaker implantation is an established treatment modality when the HR is less than 40 bpm. The management of symptomatic AF patients with SVR, in whom heart rate (HR) is in the gray zone between 40 and 60 bpm, is uncertain. There is no definitive recommendation for electrical cardioversion in patients with AF with SVR, and the outcome of rhythm control is unknown for these populations. We present two cases of sudden cardiac arrest with sustained ventricular tachycardia/fibrillation (VT/VF) after electrical cardioversion of persistent AF with SVR.

Case Report

Case 1

A 61-year-old man repeatedly visited our emergency room (ER) for dyspnea of New York Heart Association (NYHA) class III, which had first developed four months ago. Heart failure with preserved ejection fraction (HFpEF) and persistent AF were diagnosed. He had a history of hypothyroidism and cerebral infarction. His electrocardiogram (ECG) showed AF with an SVR rhythm (Figure 1A-a). Transthoracic echocardiography (TTE) showed left ventricular ejection fraction (LVEF) of 70%, left atrial (LA) diameter of 39 mm, E/E‘ ratio of 31, moderate aortic regurgitation and mild pulmonary hypertension. Coronary angiography (CAG) revealed minimal coronary artery disease (CAD). A 24-hour Holter tracing demonstrated persistent AF with a mean HR of 42 bpm (minimum 33 bpm, maximum 64 bpm), and non-sustained ventricular tachycardia (NSVT) of up to 5 beats (Figure 2A). His medications included atorvastatin, furosemide, indapamide, levothyroxine, perindopril, spironolactone, trimetazidine, and warfarin. Despite decongestive treatment with an increase in diuretics, his dyspnea did not improve. Therefore, electrical cardioversion was attempted to improve his symptoms. AF was terminated by electrical cardioversion, but junctional rhythm under 40 bpm persisted (Figure 1A-b). Finally, a permanent pacemaker of the DDDR type was implanted without any complications. However, after the procedure, the patient abruptly lost consciousness and the pulse was not palpable during transfer of the patient to the intensive care unit. The ECG monitor showed asystole. Cardiopulmonary resuscitation (CPR) and intubation were performed immediately. The rhythm strip in the pacemaker showed sustained VT, which had degenerated to VF (Figure 3A). Although his pacing rhythm was restored by CPR and repeated defibrillation under the support of extracorporeal membrane oxygenation, he eventually deteriorated and died the next day due to intractable heart failure.

Case 2

A 52-year-old man with persistent AF was referred to our center for further evaluation and management. He had exertional dyspnea of NYHA functional class II and a history of hypertension, type 2 diabetes, and transient ischemic attack. His medications included atorvastatin, dabigatran, furosemide, linagliptin, metformin, and telmisartan. A 24-hour Holter tracing demonstrated persistent AF with a mean HR of 41 bpm (minimum 32 bpm, maximum 105 bpm), and repeated NSVT up to a maximum of 20 beats (Figure 1B-a and 2B). TTE showed an LVEF of 60%, LA diameter of 44 mm, and mild pulmonary hypertension. The patient was scheduled for electrical cardioversion for rhythm control. After electrical cardioversion, complete atrioventricular (AV) block was observed (Figure 1B-b). A permanent pacemaker was implanted without any complications, and the patient was discharged with no symptoms. Six months later, he experienced sudden cardiac arrest due to polymorphic VT (Figure 3B). After ROSC, the CAG showed minimal CAD. We replaced the pacemaker with an ICD. Amiodarone was added, and the patient was discharged with no complications. However, he experienced appropriate ICD shocks several times for sustained VT and VF after discharge.

Discussion

We encountered two cases of cardiac arrest in patients with persistent AF with SVR after electrical cardioversion for rhythm control. Both patients had tolerable LV function and NYHA class II to III dyspnea despite being on medication. Although their AF showed SVR, and NSVT was also identified, pacemaker or ICD implantation was not indicated. Thus, rhythm control strategy could be selected according to the current guideline.[3] However, the patients suffered critical arrhythmic complications.

The risk of arrhythmic complications of rhythm control in AF patients with bradyarrhythmia has been pointed out since the past,[4, 5] and current guidelines recommend avoiding pharmacological cardioversion in patients with SSS or AV conduction disturbances.[3] However, guidelines do not provide a distinct recommendation for electrical cardioversion in patients with AF with SVR, and the outcome of rhythm control is unknown for this sub-population.[3] Moreover, in patients with no previous history of SSS or AV conduction disturbances, the assessment of the functional status of the SA node or AV node before cardioversion is challenging.[6] Thus, a dilemma arises in the decision of the rhythm control in patients with symptomatic AF with SVR.

The effect of ventricular rate on the outcome of electrical cardioversion remains controversial. Shin et al. reported that patients with lower heart rates before cardioversion were more likely to have bradyarrhythmic events, but Jussi et al. reported that a lower ventricular rate does not affect the success of cardioversion or predispose to complications including bradyarrhythmia.[7, 8] And, there are emerging data that rhythm control including catheter ablation in cases of predominant AF and secondary sinus nodal dysfunction can lead to resolution of the bradyarrhythmia.[9] In this respect, rhythm control strategy could be selected in patients with AF with SVR. However, meticulous evaluations including history taking, physical examination, ECG, chest radiography, 24-hour Holter recording, TTE, and treadmill test should be performed before rhythm control strategy. Additionally, NSVT was documented in both patients, which might be an ominous sign of critical arrhythmic events. However, the effect of rhythm control in AF patients with NSVT has not yet been investigated.

Conclusion

In symptomatic AF patients, the effectiveness of an active rhythm control strategy has been emphasized. However, rhythm control strategy in patients with AF who have SVR should be undertaken with caution. Careful patient selection based on the pathogenesis of AF and risk-benefit assessment may be crucial. Further prospective and large-scale randomized studies on rhythm control strategies for patients with AF and SVR are required.

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Figure Legends

Figure 1 (A) Electrocardiography (ECG) strips of case 1: (a) ECG strip shows atrial fibrillation (AF) with slow ventricular response (SVR) before cardioversion. (b) ECG strip revealed junctional bradycardia after electrical cardioversion. (B) ECG strips of case 2: (a) ECG strip shows AF with SVR before cardioversion. (b) ECG strip revealed complete atrioventricular block after electrical cardioversion.

Figure 2 (A) 24-hour Holter tracing of case 1 demonstrated repeated non-sustained ventricular tachycardia (NSVT). (B) 24-hour Holter tracing of case 2 also demonstrated repeated NSVT.

Figure 3 (A) Rhythm strip in the pacemaker of case 1 showed sustained ventricular tachycardia (VT), which had degenerated to ventricular fibrillation. (B) Rhythm strip of case 2 recorded in defibrillator demonstrated polymorphic VT.

AP, atrial pacing; PVC, premature ventricular contraction; SIR, sensor-indicated rate; VP, ventricular pacing; VS, ventricular sensing.

Figures

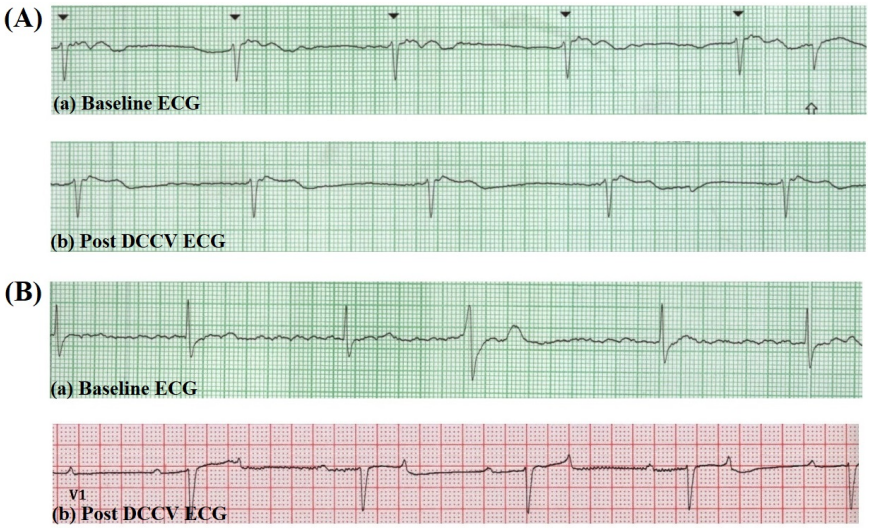

Figure 1

Figure 2

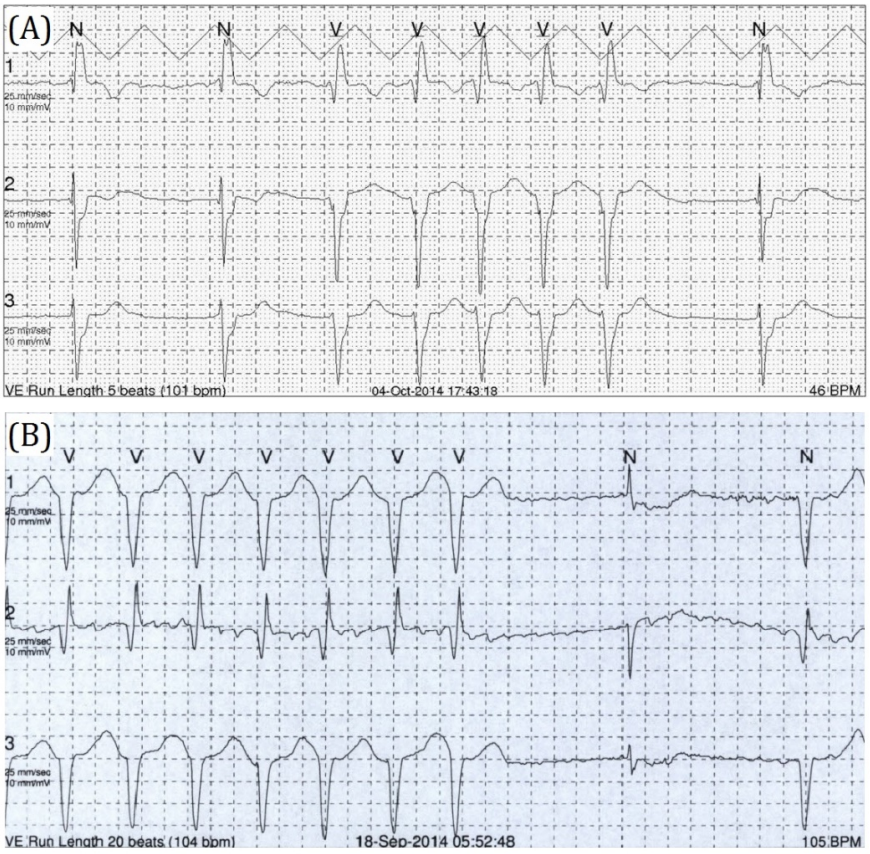

Figure 3