Case Report

DDTA mode pacing in the treatment of complete conduction block from the right atrium to the ventricles and interatrial electrical dissociation after surgical procedures

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ABSTRACT

This case report describes a 61-year-old man with a complete conduction block from the right atrium to both the ventricles and interatrial electrical dissociation that developed after removal of a left atrial myxoma and a maze surgery. A pacemaker was implanted with biatrial pacing using dual-chamber DDD pacing with triggered atrial pacing (DDTA) mode to detect the right atrial potential and to pace the left atrium while simultaneously pacing the ventricles. This approach was useful for restoring the native atrioventricular conduction, based on the intrinsic pacemaker activity in the right atrium.

1. Introduction

Dual-chamber DDD pacing with triggered atrial pacing (DDTA) is a special mode in which the atria are paced regardless of the atrial electrical potentials. In this mode, a sensed atrial potential triggers the atrial and ventricular pacing after the programmed atrioventricular (AV) delay, while a sensed ventricular potential inhibits the ventricular pacing. Recently, the use of DDTA for biatrial pacing to treat interatrial conduction disturbances and prevent atrial fibrillation was reported [1]. Here we report a case of interatrial and AV conduction block from the right atrium that developed after removal of a left atrial myxoma and was treated efficiently using the DDTA mode.

2. Case report

A 61-year-old man underwent surgical removal of a myxoma in the left atrium in January 2004. The myxoma (size, 65 × 55 mm) was resected along with part of the atrial septum, which was closed with a pericardial patch (5 × 1 cm). He also underwent a maze surgery in the left atrium using concurrent cryoablation. After that, he was followed up by a cardiovascular surgeon from our hospital. The patient experienced palpitation on exertion in March 2011. Holter electrocardiography results showed an alternating AV block and atrial tachycardia (Fig. 1), and he was referred to and then admitted to our department.

On physical examination results were as follows: height, 166 cm; weight, 56 kg; blood pressure, 90/64 mmHg; and pulse rate, irregular at 76/min. Chest radiograph showed a cardiothoracic ratio of 46% and no pleural effusion or congestion. The surface leads aVF and V1 during the electrophysiological study revealed a complete AV block (Fig. 2).

Intracardiac electrocardiograms taken at the same time showed that the right atrium was activated by the sinus node, and that the coronary sinus (CS) was activated by ventriculoatrial conduction of the AV junctional rhythm (Fig. 2). The maximum right ventricular pacing rate with 1:1 ventriculoatrial conduction was 60/min. Electroanatomical mapping of the right atrium demonstrated a wide area of low or no potential in the atrial septum, no potential area in the cavotricuspid isthmus, and disrupted conduction from the right atrium to the left atrium and both the ventricles.

Atrial tachycardia was easily induced by high-frequency stimulation of the CS, while left atrial tachycardia at a cycle length of 420 ms was conducted to the ventricles in the ratio of 1:1. However, the right atrium was activated by the sinus node. Electroanatomical mapping revealed that the atrial tachycardia was circling the mitral valve. The tachycardia was terminated by linear ablation between the mitral annulus and the left inferior pulmonary vein.

The patient later underwent permanent pacemaker implantation to treat the complete AV block. Because of conduction dissociation between the right and left atria, we used the biatrial...
pacing method. A left ventricular lead (Attain; Medtronic Inc., Minneapolis, MN, USA) typically used for cardiac resynchronization therapy was introduced through the CS and placed into the left atrial branch. This lead was used as a cathode. The right atrial lead (Capsure; Medtronic Inc.) positioned on the free wall was used as an anode to establish biatrial pacing between the right and left atria. The ventricular lead (J-Line Screwvine, Lifeline Inc., Tokyo, Japan) was implanted into the right ventricular septum. The right and left atrial leads were connected to the atrial port of the pacemaker (REPLY DR; Sorin Inc., Miran, Italy) using a bifurcated connector. In this configuration (Fig. 3), the right atrial electrical potential was tracked between the 2 atrial electrodes and the DDTA mode was used for synchronizing each chamber. The intra-atrial amplitude was 4.1 mV, and noise sensing or far field R wave sensing was not detected using the atrial sensitivity setting at 1.0 mV. The AV delay was set at 250 ms to avoid pacing the right ventricle as much as possible. The mode switching algorithm that can change from a triggered to a non-triggered mode at the atrial arrhythmia onset was also activated.

After permanent pacemaker implantation, the 12-lead electrocardiogram revealed that the pacing spike appeared at the same time as the P wave and narrow QRS complexes with AV conduction (Fig. 4). This finding demonstrated effective enforcement of the left atrial pacing. The patient had no postoperative complications and was discharged. During the subsequent 12 months, no atrial tachyarrhythmias, including atrial fibrillation, were detected, and the percentage of right ventricular pacing was < 1%.

3. Discussion

Atrial tachyarrhythmias after surgical intervention or catheter ablation in patients with structural heart disease are not uncommon because of reentry around a combination of anatomic and surgically created obstacles. However, there are few reports of interatrial electrical dissociation that originates during these procedures [2,3]. In this case, the causes of conduction dissociation between the right and left atria and the left atrial tachycardia may have been attributed to atrial muscle damage. Advanced low electrical activity in the interatrial septum suggested that resection of the atrial tissue and the patch closure performed for the removal of the huge myxoma and cryoablation for the left atrial maze caused the damage. In addition, the appearance of a complete AV block linked to the right atrial activation also implied that the damage affected the anterior regions of the AV node.

With regard to the treatment of the complete AV block in this case, if the patient was treated with the standard procedure in which leads are implanted into the right atrium and the right ventricle to perform the DDD mode pacing, right ventricular pacing would have been performed despite the remaining conduction between the left atrium and the ventricles. Because right ventricular pacing creates electrical left ventricular dyssynchrony that results in long-term unfavorable hemodynamic and structural changes, we thought that the use of this procedure was not suitable for this patient. We also considered placing leads in the
right and left atria, setting a minimum AV delay in the DDD mode, and pacing the left atrium instead of the right ventricle; however, ventricular pacing would be required when the AV conduction deteriorated. Accordingly, we adopted the DDTA mode because it was possible to sense the right atrial potential and pace the left atrium while simultaneously pacing the ventricles. This approach restored the native AV conduction based on the intrinsic pacemaker activity in the right atrium. The conduction delay in the atrium is known to induce reentry and result in atrial arrhythmias, including atrial fibrillation; therefore, the true intention of the DDTA mode was to prevent atrial fibrillation caused by interatrial conduction disturbances using biatrial pacing [1]. On the other hand, the use of inappropriate trigger pacing has the disadvantage of inducing atrial arrhythmia. However, atrial tachyarrhythmia, including atrial fibrillation, was not documented after pacemaker implantation in our case. We believe that this was due to the following reasons: first, the maze surgery and the mitral isthmus ablation effectively treated the atrial arrhythmias. Second, the mode-switching algorithm that inhibits trigger pacing worked efficiently at the onset of the atrial arrhythmias. Third, the effect of right ventricular pacing on the appearance of atrial arrhythmias decreased because of poor ventriculoatrial conductivity. This case report demonstrates for the first time that the use of a DDTA mode could be a new approach for treating patients with interatrial electrical dissociation and complete conduction blocks from the right atrium to the ventricles.

Conflict of interest

None declared.

References