Introduction

Inappropriate shocks delivered by implantable cardioverter-defibrillators (ICDs) occur in approximately 20% (15-40%) of the patients treated with these devices.\(^1\) The most frequent causes for these inappropriate shocks include paroxysmal atrial fibrillation (AF) with a rapid ventricular response and other supraventricular arrhythmias. Nowadays, dual chamber ICDs can prevent an inappropriate shock for supraventricular tachycardia. This paper describes a patient who underwent ICD (single chamber ICD) implantation, and then began to suffer inappropriate shocks because of paroxysmal AF. He received a simple pulmonary vein orifice isolation, which was successful in eliminating the paroxysmal AF.

Case Report

The patient was a 30 year-old male with dilated cardiomyopathy and syncope. He had experienced sustained ventricular tachycardia triggered by supraventricular tachycardia. Electrophysiological study revealed sustained ventricular tachycardia (VT) induced by rapid stimulation to the upper right atrium (Fig. 1). Paroxysmal AF occurred spontaneously with non-sustained ventricular tachycardia during exercise.

He received defibrillator implantation surgery in May 1997, with a Ventak Mini (Cardiac Pacemakers, Inc, St. Paul, MN, USA) device and an Endotak C-0125 transvenous lead (Cardiac Pacemakers, Inc, St. Paul, MN, USA). Implant and post implant testing revealed normal defibrillation function. The defibrillation detection interval, duration and shock energy for ventricular fibrillation were programmed at 300 ms, 10 sec and 29 joules, respectively. The first shock was delivered 8 days after the ICD implantation. An evaluation of the stored electrogram from his device revealed that this shock was delivered for rapid AF at a cycle length ranging from 137 to 359 ms. Paroxysmal AF occurred frequently, and inappropriate shocks were delivered for the rapid AF. Antiarrhythmic drugs and digitalis were not sufficient to eliminate these arrhythmias. Following these shocks, the defibrillation detection interval was changed to two zones, a ventricular fibrillation (VF) zone at a cycle length under 137 ms, and a VT zone at a cycle length from 137 to 300 ms. However, the inappropriate shocks were frequently delivered after the change in the defibrillation
His left ventricular function was severely depressed and catheter ablation for pulmonary vein orifices is not carried out in our institute. We therefore performed a simple pulmonary vein orifice isolation to eliminate the paroxysmal AF, instead of a complicated Maze procedure.

Under extracorporeal circulation and cardioplegic arrest, the left upper atriotomy was extended toward the left pulmonary vein orifices. Additional cryoablation was performed on the atrial wall remnant between the left upper and lower pulmonary vein orifice (Fig. 2). The left atriotomy was sutured completely using a running suture. The aortic cross clamping time and extracorporeal circulation time were 23 min and 46 min, respectively. After the completion of the procedure, a sinus rhythm was restored and left ventricular function was improved without any circulatory support. The exercise stress test did not induce any paroxysmal AF. He was discharged from the hospital 21 days after the surgery and did not suffer from paroxysmal AF or any inappropriate shocks after discharge.

Discussion

The incidence of inappropriate shocks ranges between 15-40% of ICD patients. The etiology of these shocks is supraventricular arrhythmias, such as AF and other atrial tachycardias. The differentiation of these supraventricular tachycardias from ventricular tachycardias has been facilitated by the development of adjunctive algorithms mechanisms. These algorithms include the ventricular activation interval stability criteria and sudden onset criteria. This report describes one etiology of inappropriate shocks; AF with a rapid ventricular response. Most of these cases can be treated by antiarrhythmic drugs and digitalis. However, these drugs did not work effectively in this patient. This clinical situation reoccurs frequently and causes further inappropriate shocks. The solution for these inappropriate shocks can be achieved by flexibility in programming and the use of a dual chamber ICD with atrial sensing. Unfortunately, we could not use a dual chamber ICD at that time, and catheter ablation for eliminating paroxysmal AF could not be performed in our hospital. We therefore selected surgical interruption of the paroxysmal AF in this case.

Recently, Haissaguere reported spontaneous initiation...
of AF due to ectopic beats originating in the left pulmonary veins and reported successful application of radiofrequency ablation at these focal sources. He also reported over 90% of ectopic beats originated from the pulmonary veins. Although we could perform an electrical interruption of atrio-ventricular conduction by catheter ablation, an atrial transport function disappeared after atrio-ventricular nodal interruption. Therefore, we performed a simple isolation of all pulmonary vein orifices and successfully eliminated paroxysmal AF. We could also restore atrial systolic function following this surgery. Although more experience is mandatory, this simple method is useful for eliminating paroxysmal AF in patients with severe left ventricular dysfunction.

References