Single-chamber, rate-responsive pacemaker-mediated tachycardia

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The case of a patient with a unipolar VVIR, who developed a sensor-driven increased pacing rate at rest following pulse generator replacement, is presented. The cause was pectoral muscle stimulation, which triggered a sensor-driven rate response in the supine position. The possible causes and management are discussed.

Key Words: Pectoral muscle stimulation; Rate responsive pacing

Pacemakers can sometimes participate in the initiation and/or perpetuation of tachyarrhythmias. The most common form of this complication is pacemaker-mediated tachycardia (PMT), which is usually caused by a premature ventricular beat that conducts retrogradely to the atrium in a patient with a dual-chamber pacemaker. We report a case of a novel mechanism of PMT caused by a sensor-mediated increased pacing rate at rest.

CASE PRESENTATION

In 1993, a 65-year-old female patient received a Medtronic Legend (Medtronic Inc, USA) VVIR pacemaker with a unipolar lead for permanent atrial fibrillation with slow ventricular rate. Due to normal battery depletion, the patient underwent pulse generator replacement and received a Medtronic Sigma SS 303 (Medtronic Inc) pulse generator in 2007. At the time of replacement, the ventricular capture threshold was 1.5 V at 0.4 ms pulse width, the R wave was 7 mV and the impedance was 437 ohms. The device was programmed to VVIR mode: base rate 70 pulses/min; maximal sensor rate 110 pulses/min; activity threshold medium/low; frequency response 7; output 2.5 V; and pulse width 0.3 ms.

During the first follow-up, the patient presented with a paced rhythm at 94 pulses/min at rest in the supine position. On inspection, rhythmic pectoral muscle activations were observed in the pocket area. The patient noticed these muscle activations in the lying position, but it did not cause significant symptoms; therefore, she did not seek medical attention for it. When the rate response function was turned off, the pacing rate immediately returned to the base rate of 70 pulses/min (Figure 1). The rhythmic muscle activations, which occurred simultaneously with each pacing spike, continued in VVI mode, but disappeared when the patient sat up. Device interrogation revealed no changes in ventricular sensing, capture threshold and lead impedance. Pectoral stimulation in the supine position was observed at as low an output as 1 V at 0.3 ms – well below the ventricular capture threshold. The patient declined a pocket revision procedure; therefore, the device was programmed to VVI mode at 70 pulses/min.

DISCUSSION

The present case represents a novel form of PMT. The pectoral muscle stimulation was detected by the rate response sensor of the device, and it triggered rate response despite the patient being at rest. The

Une tachycardie causée par un stimulateur monochambre asservi

Est présenté le cas d'une patiente ayant un stimulateur VVIR unipolaire qui s'est mise à avoir une fréquence de stimulation accrue au repos, attribuable au capteur, après le remplacement du générateur d'impulsions. Le problème était causé par la stimulation du muscle pectoral qui déclenchait une fréquence de stimulation déterminée par le capteur en position couchée. Les auteurs exposent les causes possibles et la prise en charge de cette situation.

Figure 1) Ventricular paced rhythm at 94 pulses/min in the first one-half of the strip. On turning off the rate response mode (arrowheads), the pacing rate instantaneously changes to the base rate of 70 pulses/min. **Top channel:** Lead II. **Middle channel:** Marker channel. **Bottom channel:** Intracavitary electrogram. Paper speed 25 mm/s

Medtronic Sigma device's sensor is an accelerometer that is designed to detect patient movement. However, in this case, the pectoral muscle activity produced enough chest wall movement to trigger the sensor.

Pectoral muscle stimulation can occur under various circumstances (1). Possibilities include lead insulation damage or an improper lead-device connection. Typically, the impedance changes significantly in such situations, and we observed no change in the parameters.

In unipolar devices, pectoral muscle stimulation can occur at high output, or sometimes even at low output if the pectoral muscle is easily irritable. We speculate that in the present case, the new pulse generator – being smaller than the old one – fit loosely in the pocket, and in certain positions (eg, supine position), it was able to stimulate the pectoral muscle. This complication is not expected to occur with bipolar pacing systems.

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