Clinical Medicine Insights: Case Reports

CASE REPORT

The Apparent and the Effective PR Interval, Insights for Cardiac Pacing

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Abstract: A 75-year-old-male patient with dual chamber pacemaker presented with a bizarre EKG showing a unique spike within the QRS complex. Apparent PR interval was 160 ms and effective atrio- right ventricular delay was 210 ms due to right bundle branch block. Sensed AV delay was set at 180 ms causing pseudofusions. Insights regarding cardiac pacing are presented.

Keywords: pacemaker, programming, pseudofusion

Clinical Medicine Insights: Case Reports 2011:4 69–71

doi: 10.4137/CCRep.S8227

This article is available from http://www.la-press.com.

Introduction

Pacemaker (PM) programming mandate a comprehensive knowledge of the particular patient condition and parameters must be adapted accordingly. Also, PM programming must be performed by a physician with expertise and should not be left to company technicians (CT), inadequate programming may worsen or endanger the patient condition.

Case Presentation

A 75-year-old-male patient had recent PM (Medtronic Sensia SEDR01) implanted for right bundle branch block (RBBB) with intermittent complete atrioventricular (AV) block. An experienced surgeon assisted by CT performed the procedure, the RV lead was placed at the RV apex, pre-operative electrical parameters were reported normal, the R wave was at 8 mv and ventricular sensing was set at 2 mv. During the immediate post-operative programming, "Rate adaptive AV" and "Search AV+" functions judged "superfluous" were switched "OFF" by the CT, baseline PR interval measured on surface EKG was evaluated at 160 ms and AV delay was set at 180/210 ms (sensed, SAV/paced, PAV) in order to prevent unnecessary ventricular pacing.

When the patient presented for regular PM check, his EKG (Fig. 1) showed intermittent spikes within the QRS complexes. Intracardiac markers showed As/Vp (atria sensed, ventricles paced), so atrial undersensing was ruled out, also device interrogation showed normal sensing and pacing parameters. We proceeded to gradual prolongation of the SAV delay and only at 210 ms ("effective" PR interval) and beyond, markers showed sensed ventricles (Vs) and the superfluous spikes disappeared. This case shows delayed ventricular sensing and pseudofusions caused by the combination of RBBB and inappropriate PM programming.

Discussion

The "Search AV+" algorithm in the Sensia DR PM is very efficient to enhance physiological pacing and specifically intrinsic ventricular activation. In this patient, the "Search AV+" was switched "OFF" and SAV was set at 180 ms, longer than the apparent PR interval (160 ms) but shorter than the effective PR (atrio-right ventricular delay, 210 ms) resulting in pseudofusions. Some cardiac cycles showed Vs and we hypothesized that intrinsic PR changes were probably related to vagal tone fluctuations.

Delayed ventricular sensing due to RBBB is a well known phenomenon,[1] the mechanism is explained by the delay for a spontaneous action potential to reach the right ventricular (RV) lead. This delay depends essentially on the heart anatomy, the character (complete or incomplete) of the RBBB and the site of the RV lead. For patients with RBBB and when automatic AV Search function is not available or switched "OFF", SAV delay must be set at least 40 to 50 ms longer than the baseline apparent PR interval (with Rate adaptive AV function "ON") in order to enhance intrinsic ventricular activation.

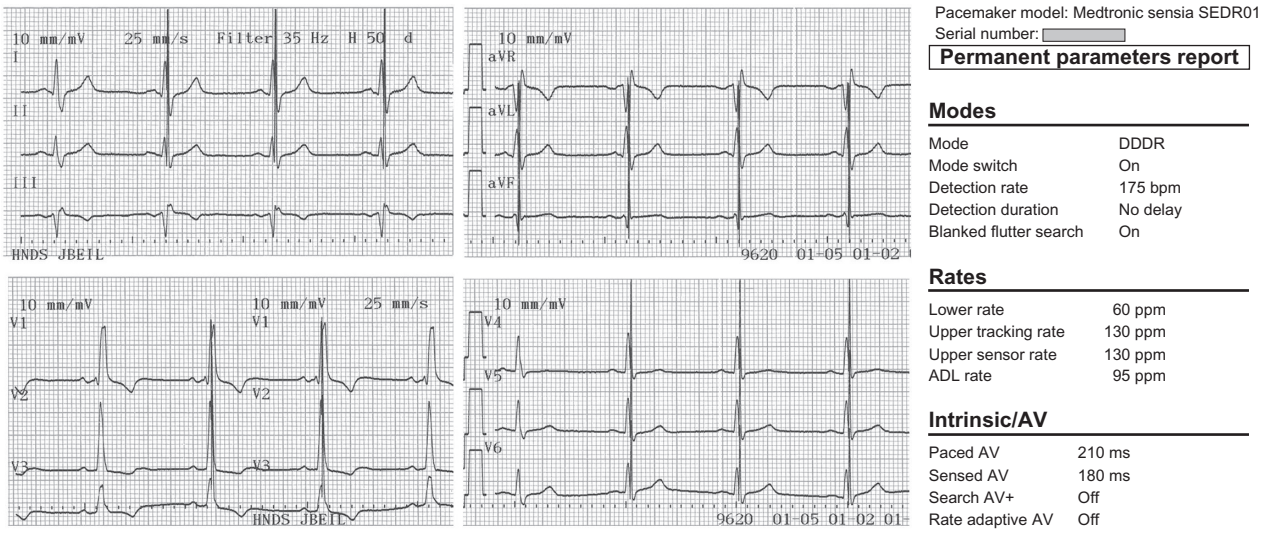

Figure 1. Surface EKG showing spikes inside the QRS complexes.

With this increasingly sophisticated technology, inappropriate programming is a relatively common incident; devices algorithms and automated functions become more and more complex, they should not be regarded as pacing accessories or gadgets because they can affect patient safety. In order to avoid such incidents, teamwork is essential and we recommend that every implantation procedure—if not performed by the electrophysiologist—must be validated by the electrophysiologist for the indication, type of device and post-operative programming. The influence of CT on the quality of cardiac pacing is predominant,[2] CT should not perform device control when unsupervised by physician with expertise.[3]

Disclosures

Author(s) have provided signed confirmations to the publisher of their compliance with all applicable legal and ethical obligations in respect to declaration of conflicts of interest, funding, authorship and contributorship, and compliance with ethical requirements in respect to treatment of human and animal test subjects. If this article contains identifiable human subject(s) author(s) were required to supply signed patient consent prior to publication. Author(s) have confirmed that the published article is unique and not under consideration nor published by any other publication and that they have consent to reproduce any copyrighted material. The peer reviewers declared no conflicts of interest.

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