CASE REPORT

A New Type of Dual Atrioventricular Nodal Nonreentrant Tachycardia

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Dual atrioventricular nodal nonreentrant tachycardia (DAVNNT) is very rarely observed clinically. The first review of this arrhythmia was published in 2011 by Wang, where four types of DAVNNT were described. Our case report presents a phenomenon that has never been published before. We revealed a very specific sequence of double fire phenomenon, 1:1 atrioventricular (AV) conduction and AV block.

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CASE REPORT

We present a 67-year-old male with an unusual arrhythmia recorded during a routine pacemaker follow-up visit. The patient had a pacemaker (Medtronic Adapta ADDR 01) implanted 4 years ago due to sinus bradycardia with first degree atrioventricular (AV) block, left bundle branch block, and symptomatic paroxysmal atrial fibrillation (European Heart Rhythm Association score of AF-related symptoms [EHRA] 3¹). After successful procedure he was treated with sotalol 80 mg twice a day with good clinical response (EHRA 1). The pacemaker was set on backup program (VVI with basic rate 50/min; hysteresis 30/min) because of poor tolerance of ventricular and dual chamber pacing. Such DDD pacing mode provoked sensations of retrosternal pain. Coronary artery disease had been excluded by means of coronary angiography performed just before pacemaker implantation. The patient did not present symptoms of heart failure. Echocardiography revealed slightly depressed ejection fraction (EF—55%) and minor tricuspid insufficiency.

On the routine follow-up visit the patient complained of palpitation and decreased physical tolerance. Such feelings were recorded by patient since about half a year and periodically also before

implantation of the pacemaker. He recognized this palpitation as paroxysms of atrial fibrillation. The 12-lead electrocardiogram revealed an arrhythmia shown in Figure 1. The same arrhythmia was recorded during 24-hours Holter monitoring 3 weeks before the visit (Fig. 3). At first glance the arrhythmia looked like supraventricular premature beats, but careful analysis of simultaneously recorded intracardiac electrograms (IEGM, Fig. 2) refuted this diagnosis. The main findings were 1:2 AV association phenomenon, wide left bundle branch block (LBBB)-like QRS morphologies, non-conducted sinus beats and T-wave abnormalities. The PR interval was 280 ms preceding 1:2 AV association and 240 ms preceding 1:1 AV association. Using pacemaker functions an electrophysiological study was performed. It revealed anterograde and retrograde nodal Wenckebach phenomenon at pacing cycle 550 and 600 ms, respectively. The arrhythmia was intermittently suppressed with atrial or ventricular overdrive pacing. Thus, dual AV nodal nonreentrant tachycardia (DAVNNT)-like arrhythmia was diagnosed and an ablation of slow pathway was recommended, but the patient did not give consent for a such procedure. Finally sotalol was switched to propafenone 150 mg twice a day with curative effect in 1-year follow-up.

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Figure 1. The 12-lead electrocardiogram of the arrhythmia. Intervals between RRs are given in milliseconds. Arrows indicate T-wave abnormalities.

Figure 2. A sample of Holter monitoring recording.

DISCUSSION

The analysis of the IEGM (Fig.3) simultaneously recorded with surface ECG reveals the sinus rhythm with repeatedly observed 1:2 AV association, 1:1 AV conduction and nonconducted sinus beats. Usually 1:2 AV association occurs in case of ventricular extrasystole. However, in presented recordings all QRS morphologies are almost the same. Also, identical QRS morphologies were observed during the atrial pacing when the arrhythmia was temporarily suppressed. The QRS are widened, which results from left bundle branch block. All above exclude ventricular premature beats as a potential mechanism of the arrhythmia. Thus, the differential diagnosis between double fire phenomenon and junctional/His-bundle ectopy ought to be done. Keeping in mind that ventriculo-atrial conduction was present, a lack of influence

of the arrhythmia on the sinus rhythm practically eliminates the junctional/His-bundle ectopy. Thus, the combination of double fire phenomenon, 1:1 AV conduction and nonconducted sinus beats form the mechanism responsible for the arrhythmia. Eventually, atypical DAVNNT² was stated as a final diagnosis. The mechanism of the arrhythmia is explained graphically in Figure 3.

Interestingly, few facts are worth noticing. First, the arrhythmia was somewhat irregularly regular. A specific repetitive sequence of AV conduction: "– 1:2 – 1:0 – 1:1 –" (Fig. 2) led to characteristic cyclic RR interval scheme: "– medium (1100–1200 ms) – short (540–720 ms) – long (1420–1600 ms) –" (Fig. 1 and 2). To our knowledge this is the first description of such sequence in DAVNNT². Anselme et al.³ observed quite a similar AV conduction alternation pattern "– 1:2 – 1:0 –" but only during electrophysiological study, and

Figure 3. Intracardiac electrograms (IEGM) and modified limb leads electrocardiograms (ECG) obtained from programmer during the pacemaker interrogation. Tracings: upper, atrial IEGM; below, ventricular IEGM and two on the bottom, ECG. SP, slow pathway; FP, fast pathway. The intervals are given in milliseconds. Arrows represent AV conduction mode.

recently Wang et al.⁴ described spontaneous alternating 1:2 and 1:1 AV conduction. Similarly, to the case presented by Wang et al.⁴ our patient had AV first-degree block and was on beta-blocker medication. However, the PR intervals behaved distinctly between these patients. The patient described by Wang et al.⁴ had PR interval longer if preceded 1:1 (280 ms) than 1:2 (220 ms) AV association, which was opposite to what we observed in our patient ($PR_{1:1} = 240$ ms and $PR_{1:2} = 280$ ms). It can be easily explained if the intervals of the AV node activation are calculated. In case of Wang et al.,⁴ the AV node was activated faster after 1:2 AV association, and on contrary in our case it happened after 1:1 AV association. Noticing this, observed differences of PR intervals can be explained by decremental conduction by the AV node. Second, the T-wave abnormalities were observed always in the first ventricular beat of 1:2 AV conduction phenomenon (Fig. 1; pointed with arrows). Although it is a rare finding in DAVNNT⁵, in our patient T-wave deformation was prominent and so imitated the atrial extrasystole.

In summary, we conclude that the presented arrhythmia is an unusual type of DAVNNT with

repetitive sequence of double-fire phenomenon, 1:1 AV conduction and nonconducted sinus beats. Additionally, we proved the possibility of pacemaker modalities in performing of electrophysiological study in selected cases of complex arrhythmias.

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