EP ROUNDS

Wide-QRS-Complex Tachycardia with a Negative Concordance Pattern in the Precordial Leads: Are the ECG Criteria Always Reliable?

KOSTAS G. KAPPOS, GEORGE K. ANDRIKOPOULOS, STYLIANOS E. TZEIS, and ANTONIS S. MANOLIS

From the 1st Department of Cardiology, Evagelismos General Hospital of Athens, Athens, Greece

KAPPOS, K.G., ET AL.: Wide-QRS-Complex Tachycardia with a Negative Concordance Pattern in the Precordial Leads: Are the ECG Criteria Always Reliable? *We present a case of wide-complex tachycardia with negative concordance in the precordial leads and a qR pattern in V6, in a 42-year-old man with risk factors for coronary artery disease, in whom the electrocardiogram criteria were apparently fallible. This case highlights the key contribution of the electrophysiological study in rendering correct diagnosis. (PACE 2006; 29:63–66)*

wide-complex tachycardia*, *ventricular tachycardia*, *supraventricular tachycardia*, *aberrancy*, *electrophysiological study

Case

A 42-year-old man presented with frequent episodes of a well-tolerated, wide-QRS-complex tachycardia. The 12-lead electrocardiogram (ECG) of the tachycardia showed a wide-QRS-complex tachycardia of 176 beats/min with left bundle branch block (LBBB) and right axis deviation morphology (Fig. 1). A negative concordance pattern of the QRS complex in leads V1 to V5 with the qR pattern in V6 was evident. The patient was a habitual smoker, obese, hypercholesterolemic, and had a positive family history of premature coronary

Address for reprints: Antonis S. Manolis, M.D., F.A.C.C., F.E.S.C., 41 Kourempana Street, Agios Dimitrios 173 43, Athens, Greece. Fax: 1493-1531; e-mail: asmanol@otenet.gr

Received September 9, 2005; accepted September 18, 2005.

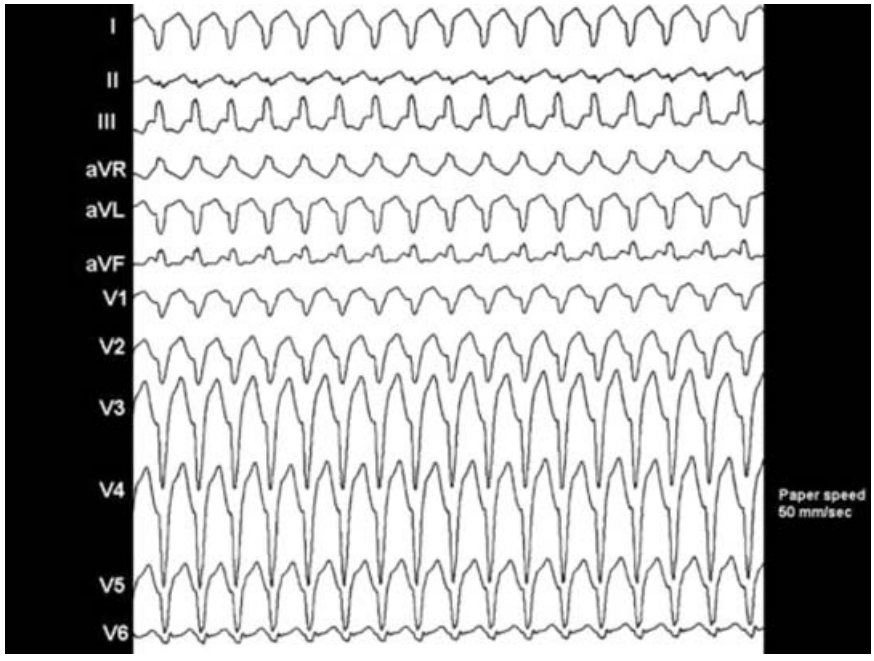

Figure 1. *Twelve-lead surface electrocardiogram of the presenting clinical tachycardia, a wide-complex tachycardia showing left bundle branch block, and right axis deviation, with negative concordance in the precordial leads and a qR pattern in lead V6.*

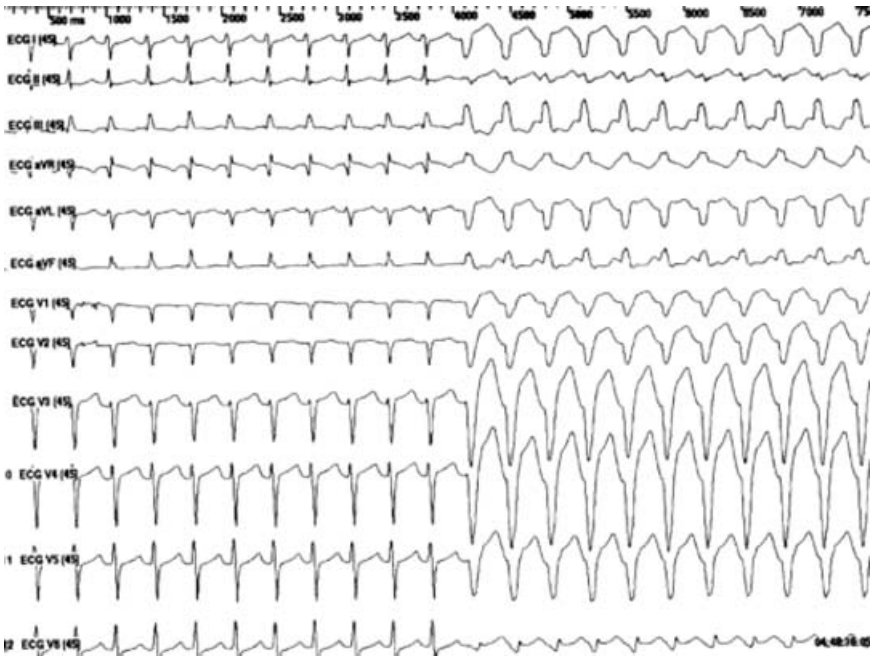

Figure 2. *Spontaneous transition of the narrow QRS-complex tachycardia (common AVNRT) into the wide-QRS tachycardia (the clinical arrhythmia).*

artery disease. However, the clinical and laboratory work-up, including detailed echocardiography study, thallium-201 scintigraphy, and magnetic resonance imaging, were not suggestive of any underlying organic heart disease.

Subsequently, the patient underwent an electrophysiological study (EPS) in order to elucidate the underlying mechanism of the tachycardia.[1,2] The study was performed following standard techniques and protocols.[3] During atrial pacing at a cycle length of 500 ms followed by a single atrial extrastimulus with a coupling interval of 410 ms, the atrioventricular (AV) conduction time increased from 210 to 336 ms and initiation of AV nodal reentry tachycardia (AVNRT) of common type (slow-fast) was observed. However, spontaneously, the induced narrow-QRS AVNRT was followed by a wide-QRS tachycardia, identical with the patient's clinical tachycardia (Fig. 2).

Is this a case of two different types of tachycardia, a ventricular tachycardia (VT) as the ECG criteria of negative concordance in the precordial leads and the qR pattern in V6 suggest, with an induced common type of supraventricular tachycardia (SVT)? Or is this a case of one tachycardia, i.e., a SVT with and without aberrancy?

Discussion

Wide-QRS-complex tachycardias comprise three distinct groups: tachycardias with permanent or functional bundle branch block (aberrancy), pre-excited tachycardias with anterograde conduction over an accessory pathway, and VT.[1,2] Accurate diagnosis of the underlying mechanism of wide-complex tachycardia, based solely on the 12-lead surface ECG, has been considered a rewarding challenge in cardiology. However, despite the accumulating experience and the development of relatively accurate ECG criteria, differential diagnosis for wide-QRS-complex tachycardia can be misleading when based solely on ECG criteria.

In our case, with regard to the differential diagnosis between VT and SVT, the age of the patient, the good clinical tolerance of the arrhythmia, and the lack of evident AV dissociation, of fusion or capture beats on ECG favored the diagnosis of SVT. However, the presence of multiple cardiovascular risk factors was in favor of VT. Moreover, the diagnosis of a tachycardia of ventricular origin was strongly supported by the presence of the negative concordance in leads V1 to V5 with qR pattern in V6. This is considered a reliable ECG criterion, especially taking into consideration that the presence of an accessory pathway resulting in an antidromic tachycardia with such an ECG pattern in the precordial leads is rather unlikely.

However, AVNRT of common type (slow-fast) was documented during EPS. Although, initially the possibility of the presence of two distinct types of tachycardias was considered, the morphology of the clinical (wide-QRS-complex) tachycardia

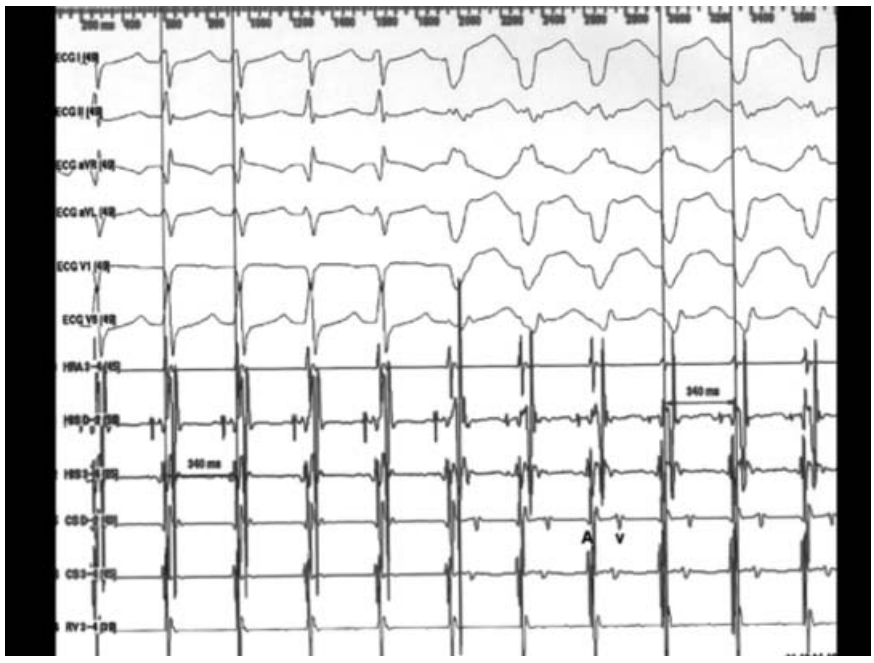

Figure 3. *The cycle length of the two tachycardias is identical (340 ms), a His bundle electrogram precedes every QRS complex with normal HV interval in both tachycardias, while the pattern of retrograde conduction is identical in both tachycardias and occurs through the normal atrioventricular conduction system, and the retrograde P-wave coincides with the QRS complex. In both tachycardias, the electrograms are suggestive of the common type of AVNRT. Note that A and V electrograms of the coronary sinus (CS) catheter are clearly separated during the wide-QRS tachycardia due to the delayed activation of the left ventricle in the presence of left bundle branch block. AVNRT indicates atrioventricular nodal reentry tachycardia.*

appeared spontaneously (Fig. 2) without any change in the tachycardia cycle length. Furthermore, a His bundle electrogram preceded all V electrograms without any H-V interval prolongation, and without any change in the pattern of the retrograde conduction (Fig. 3). Successful radiofrequency ablation of the slow pathway was subsequently performed. Repeated programmed stimulation, before and after isoproterenol infusion, did not succeed in displaying residual dual AV node physiology and in inducing any type of tachycardia.

Aberrant conduction during SVTs is not uncommon. Although many electrocardiographic algorithms have been developed, aiming to efficiently differentiate SVTs from VTs, unusual morphology of QRS due to aberrant conduction in SVTs can be misleading, challenging the diagnostic accuracy of these algorithms. In our case, the occurrence of aberrancy after the onset of tachycardia without any detectable alteration in the cycle length of the tachycardia, could be attributed not to the classical Ashman phenomenon, but to the unusual fatigue phenomenon in the His-Purkinje system, which has been shown to occur in specific atrial rates and could result in the functional LBBB that was observed.[4]

Differential diagnosis of tachycardias in patients with special anatomical characteristics can also be misleading. Volders and colleagues have recently presented a similar case, which was attributed to morphological abnormalities of the patient's chest.[5] Our patient was obese, and hence, anatomically based particular orientation of the heart vector cannot be excluded, even though we observed no specific chest deformity, nor abnormal position of the heart in our patient's chest.

In conclusion, although the commonly accepted electrocardiographic algorithms strongly suggest that the presence of wide-QRS tachycardias with negative concordance in the precordial leads is indicative of a VT originating from the apical area of the left ventricle,[6] the diagnosis of SVT with aberrancy cannot be definitely excluded on the basis of these electrocardiographic findings. The contribution of the EPS in the management of unusual cases of wide-QRS tachycardias with negative concordance pattern remains most valuable.

References

1. Blomstrom-Lundqvist C, Sheinman MM, Aliot EM, et al. ACC/AHA/ESC guidelines for the management of patients with supraventricular arrhythmias. J Am Coll Cardiol 2003; 42(8):1493–1531.
2. Manolis AS, Katsaros C, Cokkinos DV. Diagnosis and treatment of wide complex tachycardias: Results of programmed electrical cardiac stimulation. Hellenic J Cardiol 1994; 35:258–266.
3. Manolis AS, Wang PJ, Estes NAM III. Radiofrequency catheter ablation for cardiac tachyarrhythmias. Ann Intern Med 1994; 121: 452–461.
4. Barold SS, Ong LS, Young JA. Electrocardiographic observations in bradycardia and tachycardia-dependent atrioventricular block. Relationship to supernormal phase of intraventricular conduction. Chest 1975; 67(4):450–457.
5. Volders PGA, Timmermans C, Rodriquez L-M, van Pol PE, Wellens HJ. Wide QRS complex tachycardia with negative precordial concordance: Always a ventricular origin? J Cardiovasc Electrophysiol 2003; 14:109–111.
6. Wellens HJ. Ventricular tachycardia: Diagnosis of broad QRS complex tachycardia. Heart 2001; 86:579–585.