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Verapamil-Sensitive Upper Septal Idiopathic Left Ventricular Tachycardia

Prevalence, Mechanism, and Electrophysiological Characteristics

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ABSTRACT

OBJECTIVES This study sought to demonstrate the prevalence, mechanism, and electrocardiographic and electrophysiological characteristics of upper septal idiopathic left fascicular ventricular tachycardia (US-ILVT).

BACKGROUND ILVT is classified into left anterior and posterior types with no clear data about US-ILVT.

METHODS Among 193 ILVT patients, we identified 12 patients (6.2%; age 41 ± 22 years, 7 men) with US-ILVT.

RESULTS Of 12 patients with US-ILVT, 6 patients (50%) had previous history of radiofrequency catheter ablation for common ILVT. Sustained VT (cycle length: 349 ± 53 ms) was seen in all patients with a QRS interval slightly wider (104 ± 18 ms) than that during sinus rhythm (90 ± 19 ms). The VT exhibited an identical QRS configuration as sinus rhythm in 6 (50%) and incomplete right bundle branch block configuration in another 6. His-ventricular interval during VT was always shorter than that during sinus rhythm (27 ± 5 ms vs. 47 ± 10 ms). Purkinje potentials were activated in a reverse direction to that of common ILVT; namely, the diastolic potential (P_1) was activated retrogradely but the presystolic potential (P_2) was activated antegradely. At the left upper-middle ventricular septum, P_1 potential was recorded during VT, preceding the QRS by 54 ± 20 ms. Radiofrequency catheter ablation at that site eliminated the VT with no recurrence during a 58 ± 35 months of follow-up.

CONCLUSIONS US-ILVT is an identifiable VT that shares common criteria with ILVT and has a narrow QRS interval. Some US-ILVT cases appeared after common ILVT ablation. It is a reverse type of common ILVT (orthodromic form) with baseline morphological abnormalities that might provide a potential substrate for such VT. (J Am Coll Cardiol EP 2015;1:369–80) © 2015 by the American College of Cardiology Foundation.

Verapamil-sensitive fascicular tachycardia is the most common form of idiopathic left ventricular tachycardia (ILVT). It was first recognized as an electrocardiographic entity by Zipes et al. (1), who defined its morphology as right bundle branch block (RBBB) and left axis deviation. That VT was successfully suppressed by radiofrequency catheter ablation (RFCA) at the vicinity of the left

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ABBREVIATIONS AND ACRONYMS

ECG = electrocardiographic

H-V = His-ventricular

ILVT = idiopathic left ventricular tachycardia

LAF = left anterior fascicle

LPF = left posterior fascicle

LV = left ventricle

LVS = left ventricular septum

RBBB = right bundle branch block

RF = radiofrequency

RFCA = radiofrequency catheter ablation

US = upper septal

US-ILVT = upper septal idiopathic left ventricular tachycardia

VT = ventricular tachycardia

VTCL = ventricular tachycardia cycle length

posterior fascicle (LPF) (2). Another less common type of fascicular VT, characterized by RBBB morphology and right axis deviation, which has been described by Ohe et al. (3), can be suppressed by RFCA at the left anterior fascicle (LAF) area (3,4).

These types of VT have been studied almost extensively; however, little is known about the prevalence, mechanism, and surface electrocardiographic (ECG) and electrophysiological characteristics of upper septal (US) fascicular idiopathic left ventricular tachycardia (US-ILVT) (5–7). After analyzing data from 9 different experienced centers, the purpose of this study was to clarify the above-mentioned points along with the results of long-term follow-up after RFCA.

METHODS

STUDY POPULATION. From February 2006 through September 2014, in a multicenter study analyzing data of 193 patients who underwent electrophysiological study of verapamil-sensitive fascicular VT, we identified 12 patients (7 men, mean age: 41 ± 22 years) who had distinct ECG and electrophysiological characteristics of US-ILVT. In each patient, after detailed medical history and examination, structural heart diseases were ruled out by a standard investigation protocol including 12-lead ECG, chest radiographs, echocardiography, cardiac computed tomography when appropriate, and coronary angiography when indicated. The study was approved by the local research ethics committees of the participating institutes, and all patients gave their written informed consent.

ELECTROPHYSIOLOGY STUDY. An electrophysiology study was performed after withdrawing all antiarrhythmic drugs for ≥5 half-lives. Standard multielectrode catheters were placed in the high right atrium, His-bundle region, and right ventricular septum. Programmed atrial and ventricular stimulation was performed using a maximum of 3 extrastimuli at 2 different driven cycle lengths from the right atrium and right ventricular septum. If sustained VT was not induced, the stimulation was repeated during isoproterenol infusion (0.5 to 2.0 μg/min).

MAPPING AND ABLATION. RFCA was performed in 10 patients. In the remaining 2 patients (#4 and #6) who had the same clinical and electrophysiological characteristics of US-ILVT, RFCA was not performed, but an electrophysiological study was done. Through a femoral arterial approach, a 7-F quadripolar steerable electrode catheter with a 4-mm tip and 2-mm interelectrode spacing between the distal 2 electrodes was positioned at the interventricular septum of the left ventricle to record the intracardiac electrograms, as well as to pace and ablate. In a few patients, an octapolar or decapolar steerable electrode catheter with 1.25-mm electrode length and 2-mm interelectrode spacing (Boston Scientific, Natick, Massachusetts; or St. Jude Medical, Minnetonka, Minnesota) was positioned at the left ventricular septum (LVS). A 3-dimensional electroanatomical

TABLE 1 Patient Characteristics

Patient #	Age (yrs)	Sex	Presentation	Previous Common ILVT Ablation	Sinus Rhythm ECG	Verapamil-Sensitivity
1	18	M	Palpitation	1 session	Small Q-wave in leads I, II, III, aVL, and aVF	Yes
2	15	M	Syncope	2 sessions	Deep S-wave in lead I Deep Q-wave in lead III	Yes
3	38	M	Palpitation	1 session	Small Q-wave in leads II, III, and aVF	Yes
4	24	F	Palpitation	2 sessions	Deep S-wave in leads I and aVL Small Q-wave in lead III	Yes
5	83	F	Palpitation	None	Deep S-wave in lead aVL	Not administrated
6	43	F	Palpitation	None	Small S-wave in lead aVL	Not administrated
7	64	F	Syncope	None	Deep S-wave in lead III	Yes
8	66	M	Palpitation	None	Deep S-wave in leads III and aVF	Yes
9	35	M	Palpitation	2 sessions	Deep S-wave in lead I Deep Q-wave in leads III and aVF	Yes
10	41	M	Palpitation	2 sessions	Deep Q-wave in lead III	Yes
11	14	F	Palpitation	None	Small S-wave in lead I Small Q-wave in lead III	Not administrated
12	42	M	Palpitation	None	Deep S-wave in lead aVL	Yes
Mean	41 ± 22					

ECG = electrocardiography; ILVT = idiopathic left ventricular tachycardia.