Successful Radiofrequency Ablation of Atypical Left Ventricular Outflow Tachycardia Guided by Epicardial Activation Signals

M.J. Shah, N. Radhakrishnan, M. Ravikumar
The Electrophysiology Laboratory, Institute of Cardiovascular Diseases, Madras Medical Mission, Madras, India

Abstract. A 12-year-old girl, with incessant atypical idiopathic left ventricular tachycardia, underwent successful radiofrequency ablation of ventricular tachycardia focus originating from a subepicardial site adjacent to the left coronary cusp. Ventricular tachycardia was successfully eliminated by targeting an endocardial site concordant to the epicardial site of early activation. Epicardial mapping was useful in locating an effective ablation site, and aortic root angiography was used to avoid potential injury to important structures, such as the left main coronary artery and left coronary cusp.

Key words: RF ablation — Right bundle branch block — Inferior axis deviation — Left coronary cusp — Left main coronary artery — Epicardial — Subepicardial — Endocardial

Ventricular tachycardia (VT) in childhood, without underlying heart disease, is an uncommon but recognized entity [3]. Idiopathic VT usually originates from the right ventricular outflow tract with a left bundle branch block (LBBB)—inferior axis morphology on surface ECG [3, 10]. Idiopathic left ventricular (LV) tachycardia arises from the posteroseptal aspect of the left ventricle, and it produces a right bundle branch block (RBBB)—superior axis morphology [9]. There are some reports of atypical idiopathic LV VT, arising from the anterior fascicle, anterobasal region, and, infrequently, from the LV outflow tract [2, 8, 11, 13, 16]. Radiofrequency (RF) ablation of LVOT VT in children has been reported [4]. The closeness of the ablation site to the aortic valve leaflets and the epicardial left main coronary artery (LMCA) carries a potential risk of damage to these structures. In this case report, we describe successful RF ablation of an unusual incessant VT arising in the proximity of the left coronary cusp in a 12-year-old child.

Case Report

The patient is a 12-year-old girl who was referred to our institution for treatment of incessant VT. A rapid heart rate was detected on routine school physical examination, but she was otherwise asymptomatic. A 12-lead ECG showed wide QRS tachycardia with RBBB morphology and inferior axis deviation (Fig. 1B). A 24-hour Holter monitor showed continuous VT at an average rate of 150 beats/min throughout the recording (99.8% of the rhythm) with ventriculoatrial dissociation. Echocardiography reported normal cardiac anatomy, no evidence of cardiac mass, mildly dilated LV, and reduced ventricular shortening (FS 22%). There was no history suggesting viral illness. She was not on any medications, and serum chemistries, including thyroid function tests, were within normal limits. An electrophysiology (EP) study was performed. Intravenous verapamil and adenosine failed to slow or terminate VT. Overdrive ventricular pacing did not demonstrate entrainment of VT, and burst ventricular pacing did not result in VT termination. On administering additional local anesthesia (1% lidocaine, total dose 1.5 mg/kg) at catheter insertion sites, VT terminated. Ventricular tachycardia could not be reinitiated with incremental atrial and ventricular pacing and programmed ventricular stimulation at baseline and on isoproterenol infusion (2mcg/min) from the right ventricle apex and right ventricle outflow tract. A baseline hemodynamic study was performed, which demonstrated normal right-sided pressures and a mean pulmonary capillary wedge pressure of 10 mmHg. Four hours after completion of the EP study, incessant VT recurred. The VT responded to intravenous lidocaine infusion and the patient was put on oral mexiletine 150 mg t.i.d (10 mg/kg/day). She remained in sinus rhythm. In order to avoid daily medication, she opted for a RF ablation 6 months later.

Procedure

Radiofrequency ablation was performed after discontinuing mexiletine and obtaining informed consent. The patient was in incessant VT during the procedure with the same ECG characteristics as the previously documented VT. Quadripolar 6 French
electrode catheters (Bard Electrophysiology, Billerica, MA, USA) were positioned in the high right atrium, the His bundle region, and RVA. A decapolar 6 French catheter was placed in the coronary sinus. A 7 French quadripolar steerable ablation catheter, with a 4-mm tip and 2-mm interelectrode spacing between the distal two electrodes (Cordis Webster Inc., Baldwin Park, CA, USA), was inserted retrogradely across the aortic valve for mapping and ablation. Intravenous heparin was administered in a bolus dose of 100 i.u/kg units, followed by an infusion at a rate of 10 i.u./kg/hr. Surface ECG leads and bipolar intracardiac electrograms from various sites were displayed simultaneously and recorded on a multi-channel recorder. The location of mapping electrodes was identified using single plane fluoroscopy in a left oblique (LAO 45°) projection. An optimal early activation site could not be identified with mapping during VT in the conventional septal, LVOT, and anterobasal regions. Neither could the site be identified above the aortic valve in the sinuses of Valsalva [2, 8, 16]. With further flexion of the catheter near the left sinus of Valsalva, early activation electrography (preceding surface ECG QRS by 28 msec) was

Fig. 1. (A) Twelve lead surface ECG showing incessant ventricular tachycardia at 150 beats/min. The QRS configuration has a RBBB morphology with inferior right axis deviation. (B) Twelve lead surface ECG showing sinus rhythm after successful ablation of ventricular tachycardia.