Electrocardiogram Characteristics of Outflow Tract Ventricular Tachycardia

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KEYWORDS

• Outflow tract • Electrocardiogram • Ventricular tachycardia • Idiopathic ventricular tachycardia
• Intracardiac electrogram

KEY POINTS

- The mechanism underlying outflow tract ventricular tachycardia (VT) is delayed after depolarization-mediated triggered activity.
- Outflow tract VT arises from a focal site, and these patients generally lack structural heart disease. Thus, pace mapping can be used to mimic the clinical VT.
- Outflow tract VTs most commonly arise from the superior right ventricular (RV) outflow tract, aortic cusp region, basal left ventricle and the great cardiac/anterior interventricular vein.
- At the site of origin, local activation precedes QRS complexes by 15 to 30 milliseconds, and pace mapping from this location matches the clinical arrhythmia.
- Electroanatomic mapping facilitates accurate catheter localization in the outflow tract region.

INTRODUCTION

Pathophysiology

Ventricular tachycardias (VTs) are usually observed in the setting of structural heart disease. However, in 10% of patients presenting with VT, routine diagnostic modalities demonstrate no myocardial damage. These arrhythmias have been called idiopathic ventricular tachycardias (IVTs).[1]

Outflow tract tachycardias comprise a subgroup of IVTs that are predominantly localized in and around the right and left ventricular outflow tracts (RVOT and LVOT, respectively). Lerman and colleagues[2] demonstrated that the mechanism underlying this group of arrhythmias appears to be triggered activity caused by delayed after depolarizations that are determined by intracellular calcium release (load). The release of calcium is negatively affected by adenosine, which is why these arrhythmias are considered adenosine sensitive.[3]

Clinical Presentation

In general, outflow tract tachycardias can manifest at any age and equally in both sexes.[4] The typical presentation of these arrhythmias consists of salvos of paroxysmal ventricular ectopic beats and nonsustained VT; sustained tachycardia is uncommon. Most patients (48%–80%) experience palpitations. Presyncope and lightheadedness may

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also be observed (28%–50%). True syncope is infrequently seen (overall incidence, <10%), and these rhythm disorders are rarely life threatening.[5–7] Outflow tract tachycardias are typically provoked by exercise in most patients.[5,8] Other triggers for inducing or enhancing the arrhythmia include stress, anxiety, and stimulants such as caffeine. In women, outflow tachycardias are more often observed during premenstrual or perimenopausal periods and with gestation, suggesting the role of hormonal influences.

Distribution

In the earlier experience at the authors' center (January 1999 and December 2003) of 122 patients undergoing ablation for IVT, the site of origin (SOO) was localized to the RVOT region in 88 patients (72%). More recently (2004–2008), however, the authors have noted a preponderance of the SOO from the cusp region.[1,9]

This article describes the unique electrocardiogram (ECG) morphologies of outflow tract VT by means of their SOO. It also briefly outlines strategies that the authors have used for successfully ablating these arrhythmias.

ECG CHARACTERISTICS OF OUTFLOW TRACT VT

RVOT Versus LVOT

Outflow tract tachycardias typically manifest an inferior axis (positive deflections in the inferior leads) and a left or right bundle branch block pattern (LBBB and RBBB, respectively), based on QRS morphology in lead V1. These arrhythmias can manifest diverse axes and different precordial transition patterns (early, late, or none) (Fig. 1). A predominantly or exclusively positive deflection in lead V1 is considered RBBB morphology, which suggests origin from the LVOT, whereas a predominantly negative deflection in lead V1 is considered LBBB morphology; tachycardias manifesting this morphology can arise from either the RVOT or septal LVOT. The precordial transition is helpful in predicting whether VT manifesting LBBB is arising from the RVOT or septal LVOT or the cusp region. Typically, if the precordial transition of the VT is later than that of the QRS complexes in sinus rhythm, then the SOO is likely in the RVOT. If the precordial transition is at V3 or earlier and occurs before the transition in sinus rhythm, the QRS complex in lead V2 should be further analyzed to distinguish between an RVOT

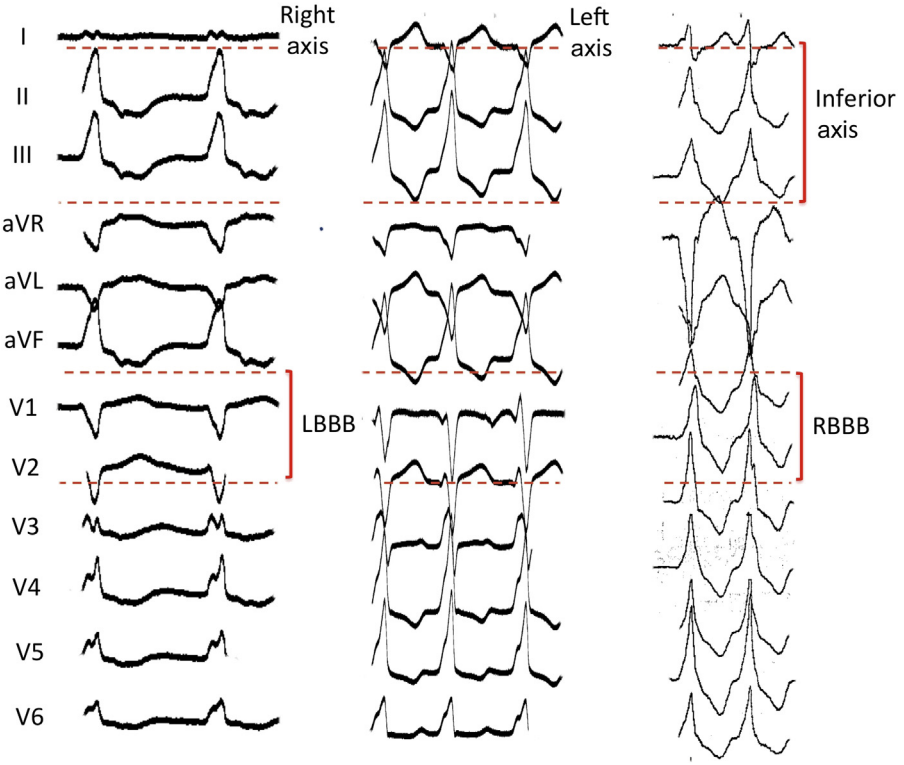

Fig. 1. Examples of variable 12-lead ECG characteristics encountered in outflow tract VT. They manifest inferior axis with either RBBB or LBBB patterns, and either a right or left axis.