

# Discover Origins of Arrhythmia



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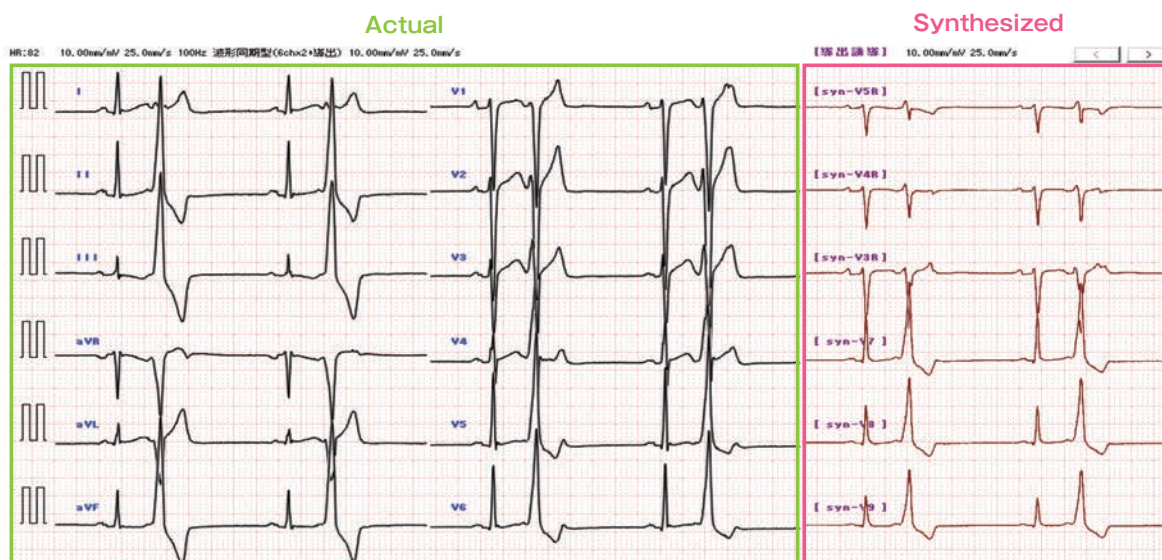
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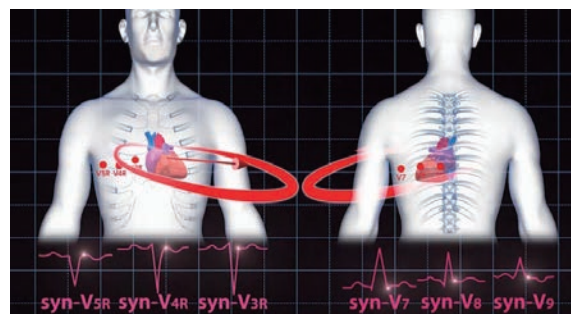
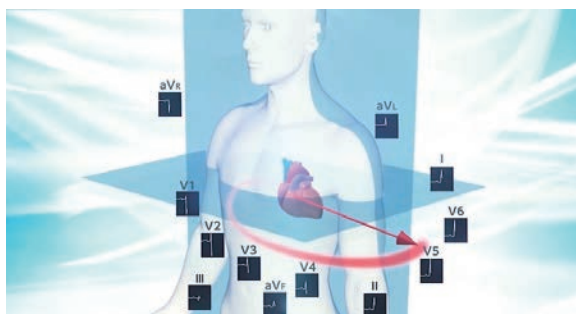
There are many reports on the ECG characteristics of idiopathic outflow tract ventricular arrhythmias (OT-VAs) to predict their origin. However, differentiating near regions using 12-lead ECGs is still complicated. The synthesized 18-lead ECG derived from the 12-lead ECG can provide virtual waveforms of the right-sided chest leads (V3R, V4R, and V5R) and back leads (V7, V8, and V9) (**Figure 1**). The aim of this study was to develop a simple and useful parameter for differentiating OT-VA origins using the 18-lead ECG.



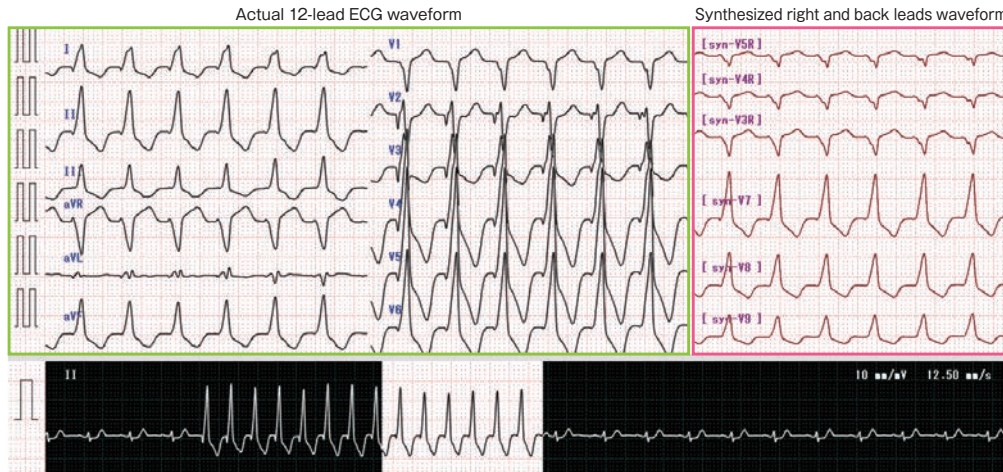
**Figure 1** 18-lead ECG

## Principle of Synthesized Waveforms

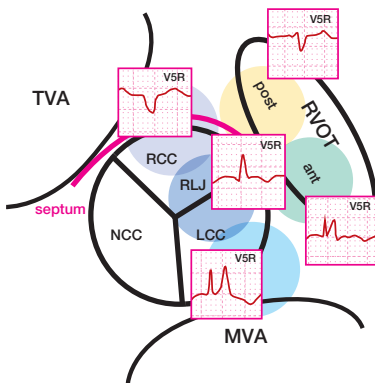
Instantaneous cardioelectric vectors are continuously measured from the standard 12-lead ECG data and ECG of the right leads (V3R, V4R, V5R) and back leads (V7, V8, V9) is synthesized from this data.



We studied 28 and 73 patients with idiopathic VAs in a pacemapping study and validation cohort, respectively. In the pacemapping study, several sites out of five different sites were paced in each patient: the anterior and posterior right ventricular OT(RVOT-ant and RVOT-post), right and left coronary cusps (RCC and LCC), and junction of both cusps (RLJ). The 18-lead ECGs during pacemapping among the five sites were compared for establishing a simple parameter to predict VA origins (Table 1). A novel parameter using 18-lead ECGs was tested prospectively in 73 patients. In the pacemapping study, the dominant QRS morphology pattern in the synthesized V5R significantly differed among those sites (RVOT-ant:Rs, RVOT-post:rS, RCC:QS, RLJ:qR, and LCC:R) (Figure 2, 3). The patients in the validation cohort were divided into five groups depending on those QRS morphology patterns during VAs in the synthesized V5R. Each V5R QRS morphology pattern could predict a precise origin of the OT-VAs with an overall accuracy of 75% (Table 1, 2).



**Figure 2** 18-lead ECG during pace mapping



**Figure 3** The schema of the relationship between the different pacing sites and QRS morphology patterns in V5R.

**Table 1** The relationship between the QRS morphology pattern in the synthesized V5R and the results of the RFCA of idiopathic VAs

		RVOT-ant	RVOT-post	RCC	RLJ	LCC	Other
Rs	n=13	10 (77%)	1 (8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
rS	n=23	5 (22%)	17 (74%)	0 (0%)	1 (4%)	0 (0%)	0 (0%)
QS	n=3	0 (0%)	0 (0%)	2 (67%)	0 (0%)	0 (0%)	1 (33%) <sup>a</sup>
qR	n=7	0 (0%)	0 (0%)	0 (0%)	7 (100%)	0 (0%)	0 (0%)
R	n=27	5 (18%)	0 (0%)	1 (4%)	1 (4%)	19 (70%)	1 (4%) <sup>b</sup>

a: Right ventricular inflow region, b: Unsuccessful RFCA

**Table 2** The usefulness of the QRS morphology pattern in the synthesized V5R for differentiating the origins of idiopathic VAs in the prospective study

	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	P-value
'Rs' for predicting RVOT-ant	50	94	77	83	<0.001
'rS' for predicting RVOT-post	94	89	74	98	<0.001
'QS' for predicting RCC	67	99	67	99	0.003
'qR' for predicting RLJ	78	100	100	97	<0.001
'R' for predicting LCC	91	85	70	96	<0.001

RVOT-ant, anterior right ventricular outflow tract; RVOT-post, posterior right ventricular outflow tract; RCC, right coronary cusp; RLJ, junction between right and left coronary cusps; LCC, left coronary cusp; PPV, positive predictive value; NPV, negative predictive value.

**Conclusion**

The QRS morphology pattern in V5R was a simple and useful parameter for differentiating detailed OT-VA origins.

**Reference** Miyako Igarashi, Akihiko Nogami, Kazutaka Aonuma, et. al. The QRS Morphology Pattern in V5R is a Novel and Simple Parameter for Differentiating the Origin of Idiopathic Outflow Tract Ventricular Arrhythmias. *Europace*. 2015 Jan 6. pii: eu337.