

Synthesized 18-lead ECG: A New Technology for More Informative ECG Exam

What is Synthesized 18-lead ECG?

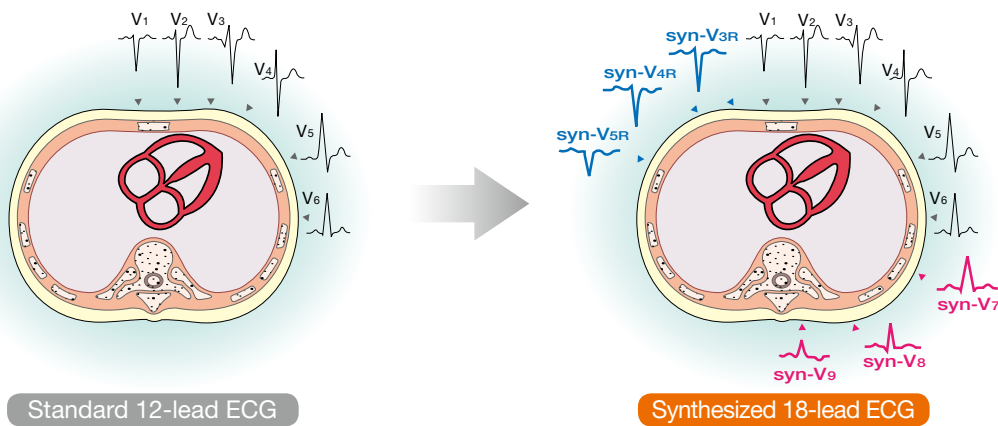
The most common ECG exam is the standard 12-lead ECG. It is simple to measure, has low burden on the body, and observing the heart from these 12 directions provides a lot of information which has a wide range of clinical applications.

However, some areas, especially pathological change in the right ventricle and the posterior wall cannot be observed from the 12-lead ECG.

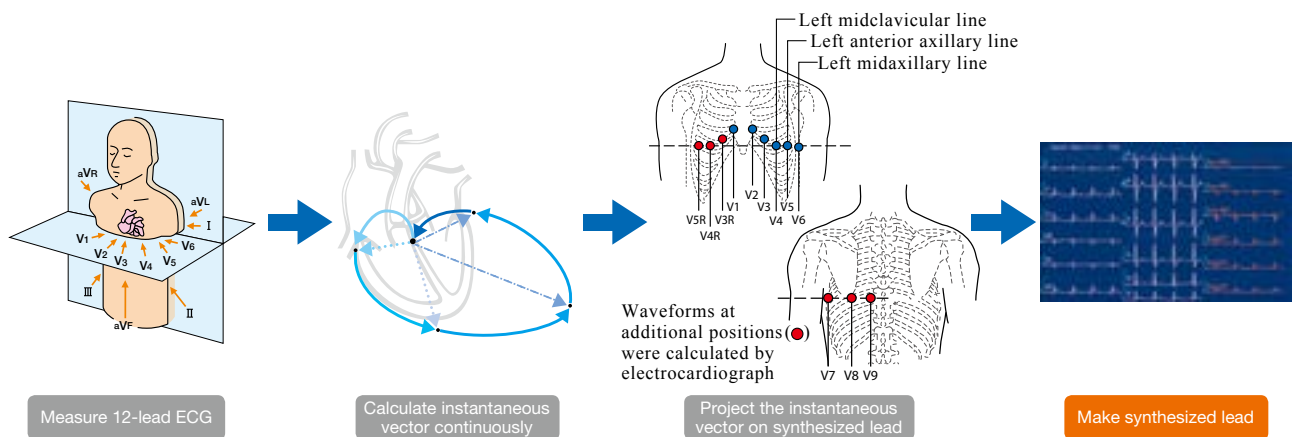
In order to actually measure the right chest (V3R, V4R, V5R) and back (V7, V8, V9) areas, it is necessary to use different electrode positions than the standard 12-lead ECG. In particular, electrodes must also be attached to the patient's back so that normal suction cup electrodes cannot be used. Also, the patient must be turned over in some cases and in an emergency it is often difficult to use back electrodes. This complicates the exam procedure.

Synthesized 18-lead ECG uses the 12-lead ECG waveforms to mathematically derive the waveforms of the right chest leads (V3R, V4R, V5R) and back leads (V7, V8, V9).

The measurement procedure is the same as the standard 12-lead ECG but more information can be obtained.



Synthesized right side leads (V3R – V5R) and synthesized back leads (V7 – V9) are added



Discover Origins of Arrhythmia

There have been many reports about ECG characteristics of idiopathic outflow tract ventricular arrhythmias (OT-VAs). However, differentiating near regions using the 12-lead ECG still remains complicated and these methods do not have good results.

Then the usefulness of additional 6 lead ECG (V7, V8, V9, V3R, V4R, and V5R) was evaluated for differentiating the origin of OT-VAs by synthesized 18-lead ECG which is calculated from standard 12-lead ECG. (Please see the back side of this paper for detailed information about synthesized 18-lead ECG.)

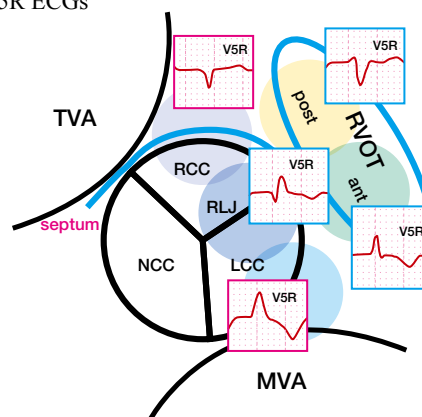
The patients were divided into 4 groups depending on the successful radiofrequency catheter ablation site: anterior and posterior of right ventricular OT (RVOT-ant-group, RVOT-post-group), right coronary cusp or junction of these two cusps (RCC-RLJ-group), and left coronary cusp (LCC-group) The QRS morphology patterns in synthesized V5R at each site were categorized into 4 types: Rs, rS, q and R.

As shown in Table 1, high sensitivity and specificity indicates the utility of synthesized 18-lead ECG as a parameter and the QRS morphology pattern in synthesized V5R is useful to precisely differentiate the origins of OT-VAs.

Table 1

	RVOT-post n=16	RVOT-ant n=9	RCC-RLJ n=9	LCC n=16	<i>p</i>
QRS In V5R					<0.001
rS	15 (94%)	2 (22%)	1 (11%)	0 (0%)	
Rs	1 (6%)	7 (78%)	1 (11%)	1 (6%)	
qR, QS	0 (0%)	0 (0%)	5 (56%)	0 (0%)	
R	0 (0%)	0 (0%)	2 (22%)	15 (94%)	

Figure 1
Representative synthesized
V5R ECGs



Reference

The QRS morphology pattern in V5R is novel and simple parameter for differentiating the origin of idiopathic outflow tract ventricular arrhythmias

Igarashi M, Kuroki K, Adachi T, Yui Y, Ito Y, Ogawa K, Talib A, Sekiguchi Y, Nogami A, Aonuma K, ESC congress 2014 August 30 - September 3; Fira Gran Via, Barcelona, Spain