

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

What is Synthesized 18-lead ECG?

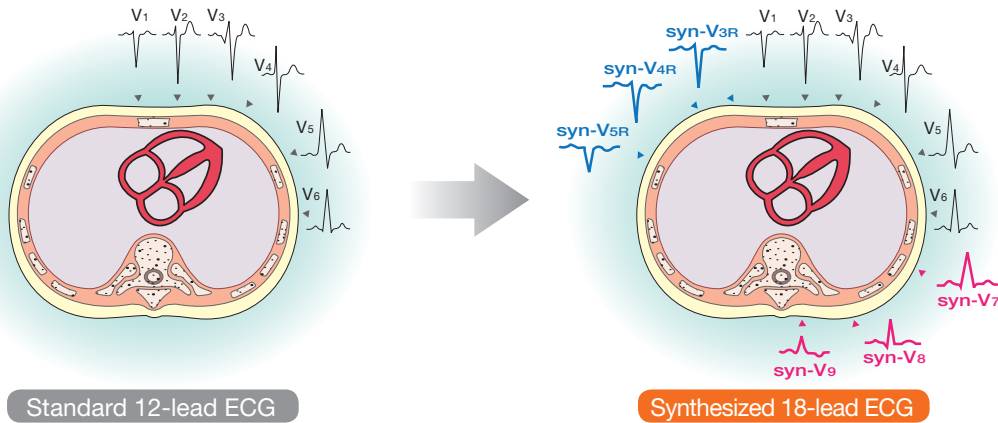
The most common ECG exam is the standard 12-lead ECG. It is simple to measure, has low burden on the body, and observing the heart from these 12 directions provides a lot of information which has a wide range of clinical applications.

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).

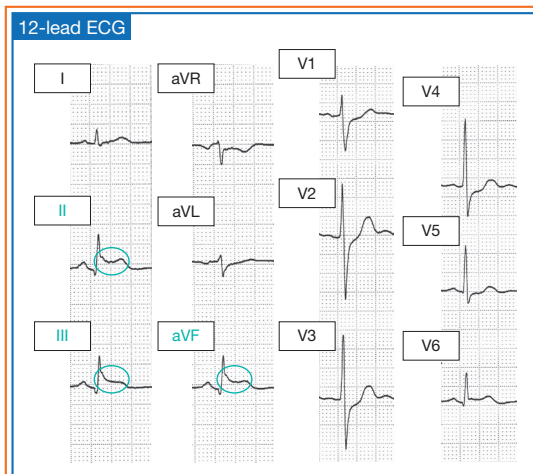
The measurement procedure is the same as the standard 12-lead ECG but more information can be obtained. 18-lead synthesized ECG is expected to be useful in detecting right side and posterior infarction.



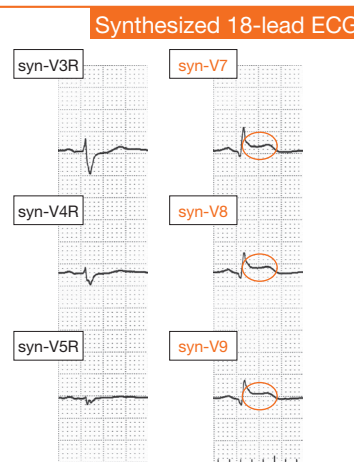
Standard 12-lead ECG

Synthesized 18-lead ECG

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



Inferior wall infarction



Posterior wall infarction

Identify Invisible Ischemia

Diagnose synthesized ECG on right ventricular and posterior wall

Guidelines such as AHA, ACC or ESC recommend to measure additional lead (V3R-V5R and V7-V9) for the patient with suspected acute coronary syndrome. Actually, there are low cases of additional leads' measurement due to complication of procedure or burden on patients. synECi18 provides the additional information for right ventricular and posterior wall from standard 12 lead ECG without any additional procedure.

In one research 1), standard 12-lead ECG and additional leads (V3R, V4R, V5R, V7, V8 and V9) for walk-in patients who have acute chest pain have been measured. Then, synthesized lead (syn-V3R, syn-V4R, syn-V5R, syn-V7, syn-V8, syn-V9) derived from standard 12-lead ECG.

As shown on fig.1, there are high correlation between both actual lead and synthesized lead. It result in no difference in the result of patients who have significant ST elevation due to acute myocardial infarction on right ventricular or posterior wall.

Synthesized lead for right ventricular and posterior wall helps to identify invisible ischemia which is difficult to be shown on standard 12-lead ECG.

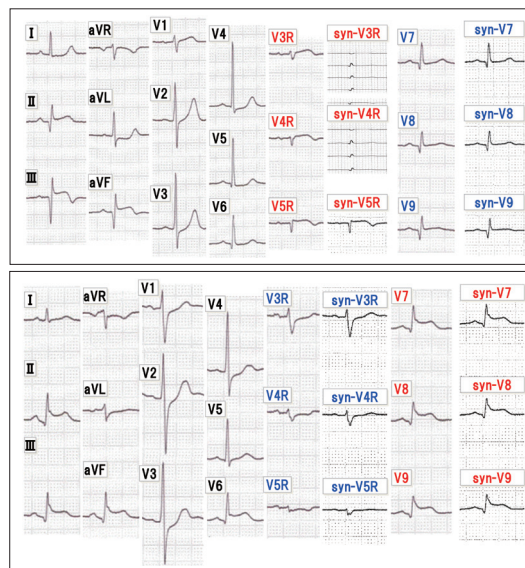
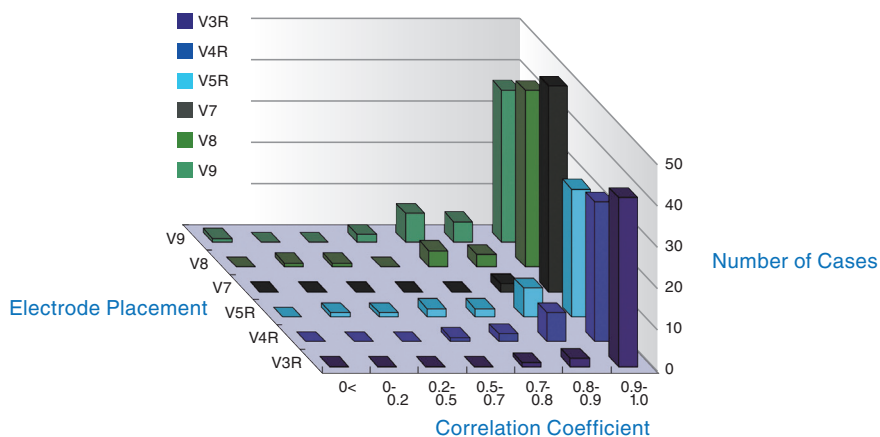


Fig.1 Comparison between waveform for both actual additional lead (V3R, V4R, V5R, V7, V8, V9) and synthesized lead



Reference:

- 1) Katoh T., et al., Clinical Significance of Synthesized Posterior Right-Sided Chest Lead Electrocardiograms in Patients with Acute Chest Pain. J Nippon Med Sch 2011; 78 (1): 22-29.
- 2) Wei D: Derived electrocardiograms on the posterior leads from 12-lead system: method and evaluation. Proceedings of the 25th Annual International Conference of IEEEEMBS 2003; 1: 74-77.