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Editorial

Revisiting Application of Exercise Electrocardiography in Patients with Stable Ischemic Heart Disease

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▸ See the article "Comparison of Exercise Performance and Clinical Outcome Between Functional Complete and Incomplete Revascularization" in volume 50 on page 406.

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Exercise electrocardiography (ExECG) is characterized by lower cost, widespread availability, and ease of performance for documenting ischemia in patients with suspected coronary artery disease or proven stable ischemic heart disease (SIHD). It can also provide complementary prognostic information such as exercise capacity, arrhythmias, and exercise-induced symptoms that are closely correlated with future cardiac events (cardiac death and nonfatal myocardial infarction).[1)2)] Therefore, the previous American College of Cardiology (ACC)/American Heart Association (AHA) guidelines supported ExECG as the initial choice of test for ischemia in patients who are able to exercise and have a normal electrocardiogram at baseline.[3)]

Nevertheless, the value of ExECG is discounted by its lower sensitivity, ranging between 45% and 50% for detecting significant coronary artery disease anatomically defined as diameter stenosis more than 50%, when compared with other imaging modalities.[4)] In a recent meta-analysis, Knuuti et al.[5)] suggested the best pre-test probability (PTP) ranges for various non-invasive tests to rule-in and rule-out significant CAD. ExECG has very limited ranges of PTP of rule-in (when PTP is ≥80%, the positive result can confidently confirm the diagnosis) and rule-out (when PTP is ≤19%, the negative result can confidently exclude the diagnosis) for diagnosis of CAD (diameter stenosis >50%).[5)] Based on this background, the recent European Society of Cardiology (ESC) guideline changed its stance, demoting the role of ExECG to an alternative test while promoting non-invasive imaging modalities as the initial test to document coronary artery disease (CAD).[6)]

In this issue of the *Korean Circulation Journal*, Kim et al.[7)] demonstrated the usefulness of the ExECG test in the assessment of the benefit of percutaneous coronary intervention (PCI) in the SIHD population by presenting that ExECG can objectively identify changes in exercise duration and the extent of angina relief along with resolution of ischemic ST-segment after PCI. The complete revascularization group defined by negative conversion of the ExECG test result after PCI had significantly more gain in exercise duration (+62 vs. +30 seconds, p=0.011) and in Duke treadmill score (+13.3±5.1 vs. +4.0±6.1, p>0.001) and lower incidence of exercised-induced angina (6.0% vs. 26.5%, p<0.001) compared with the incomplete revascularization group defined by having positive ExECG test after PCI. The complete revascularization group had significantly fewer adverse cardiac events (6.2% vs. 26.1%) up to 3 years of follow-up after PCI, though this was mainly driven by additional revascularization

events. It should be acknowledged that ExECG has the ability to quantify the benefit of PCI and to identify those patients who could be managed best with conservative medical therapy alone or invasive revascularization.

Nevertheless, it must be considered that this result was drawn in a highly selective population predominantly comprising male patients (85%) with a mean age of 60 years and at least one proven CAD treated with PCI, representing only 8% (256 out of 3,208) of those who underwent PCI for SIHD in that institution. This is completely different from the population in whom the establishment of a diagnosis of CAD would be a major concern in the context of the need to implement plaque stabilization treatments. In such situations, a test with higher sensitivity might be more appropriate than ExECG. For those who already have a diagnosis of CAD, by contrast, it would be a more important consideration to identify the patients who would obtain the benefit of revascularization most, rather than to determine whether they simply have ischemia. Therefore, the specificity of a test takes priority over sensitivity. ExECG has relatively high specificity of 85–90% for anatomically defined CAD, a surprisingly high number when considering 73% of specificity of invasive coronary angiography for detection of functionally defined significant CAD (fractional flow reserve<0.80).[4)5)] From the viewpoint of the myocardial ischemic cascade model, pathologic ECG change and angina occurs at a later stage of that cascade, rendering the ExECG test more specific for detecting functionally very significant CAD at the cost of sensitivity.[8)] In conclusion, a strategy using ExECG is a viable option to recognize patients who have ischemia so severe enough that they will obtain a better prognosis when the ischemia is relieved by revascularization; the study conducted by Kim et al. in this issue well represents this role of the ExECG test.

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