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Editorial

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Clinical Utility of Coronary Computed Tomography Angiography, Beyond the Gatekeeper for Invasive Coronary Angiography

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In the diagnosis and management of coronary artery disease (CAD), the risk stratification strategy has been employed to identify patients likely to have obstructive CAD that might benefit from revascularization. Since the decision to perform coronary revascularization has traditionally depended on ischemia testing, functional modalities that evaluate myocardial ischemia have been widely utilized as gatekeepers for invasive coronary angiography.[1] However, the introduction of coronary computed tomographic angiography (CCTA), which provides noninvasive direct visualization of coronary atherosclerosis, has caused a paradigm shift in the diagnosis of CAD from functional to anatomic testing.

In the early days of CCTA, its excellent negative predictive value was highlighted; hence, CCTA was regarded as an alternative to functional tests in patients with a low-intermediate pretest probability of CAD.[2] However, accumulating data supports its utility for individuals at higher risk, and CCTA has been increasingly accepted as an effective imaging modality for primary testing in patients with suspected CAD.[3] In this issue of the *Korean Circulation Journal*, Cha et al.[4] indicates the increasing use of CCTA as a gatekeeper for invasive coronary angiography, along with the decreasing use of the treadmill test, single photon emission computed tomography, and direct invasive coronary angiography. Increased use of CCTA is thought to be driven in part by its better prediction of obstructive CAD, increasingly strong outcome data, and similar or lower cost compared to that for functional imaging tests.[3]

Compared with functional modalities that focus on the evaluation of myocardial ischemia, CCTA, with its ability to visualize coronary atherosclerosis directly, allows for the detection of nonobstructive, as well as obstructive CAD. Therefore, CCTA provides an opportunity for further risk stratification and personalized medical treatment, even in patients who do not require revascularization.[5][6] Additionally, there is accumulating data on whether the CCTA-first strategy ultimately improves the patient's prognosis. The SCOT-HEART (Scottish Computed Tomography of the Heart Trial), which randomized the addition of CCTA to standard care versus standard care alone, demonstrated that the CCTA-first strategy clarifies the diagnosis and enables the targeting of interventions.[7] Moreover, although the PROMISE (Prospective Multicenter Imaging Study for Evaluating of Chest Pain) randomized controlled

Data Sharing Statement
The data generated in this study are available from the corresponding author upon reasonable request.

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trial failed to prove that the CCTA-first strategy improves clinical outcomes compared to that with function testing at a median follow up of 2 years,[8] the SCOT-HEART demonstrated a significantly lower occurrence of myocardial infarction and CAD death in the CCTA-first arm at the 5-year follow up.[9]

Furthermore, CCTA uniquely provides accurate quantification and characterization of coronary atherosclerosis.[3] Visual identification of high-risk plaque features, such as positive remodeling, low attenuation plaque, spotty calcifications, and the napkin ring sign, strongly correlate with adverse histologic and intravascular ultrasound features and predict future events.[10][11] Assessment of high-risk plaque features in combination with quantitative plaque characteristics by CCTA, such as diameter stenosis, provide a more reliable risk stratification.[12][13] In addition, as the image quality of CCTA has improved, volumetric quantification of coronary atherosclerosis in whole coronary trees and the volume of each plaque component (necrotic core, fibro-fatty, fibrous, and calcified plaque), as well as total plaque volume, has recently become feasible.[3][13] Quantitative CCTA analysis not only provides further risk stratification beyond that with a conventional analysis, but also enables the observation of plaque progression over time. This is of clinical importance since serial quantification and characterization of CAD can be used to evaluate the effects of medical treatment. For instance, the PARADIGM (Progression of Atherosclerotic Plaque Determined by Computed Tomographic Angiography Imaging) study showed that statin use is associated with slower progression of the total plaque volume, with reductions in high-risk features, while increasing plaque calcification.[14] This characteristic of CCTA is very useful for developing and evaluating the effect of targeted treatments, and will ultimately contribute to improving the prognosis of patients with CAD.

Although the United States guidelines do not yet incorporate CCTA as a first-line modality for the evaluation of suspected CAD, accumulating evidence supports the clinical utility of CCTA in patients with various stages of CAD. Furthermore, CCTA provides quantification and characterization of coronary atherosclerosis over entire coronary trees, aiding in the diagnosis, risk stratification, and treatment decision. Therefore, we need to fully utilize comprehensive and quantitative information obtained from CCTA to improve patient outcomes.

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