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Editorial

Clinical Utility of Third-generation Dual-source Computed Tomography for Left Ventricular Function Analysis and Coronary Artery Evaluation with Minimal Radiation Exposure

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▸ See the article "Simultaneous Assessment of Left Ventricular Function and Coronary Artery Anatomy by Third-generation Dual-source Computed Tomography Using a Low Radiation Dose" in volume 28 on page 21.

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Conflict of Interest
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With advances in acquisition techniques of computed tomography (CT), coronary computed tomography angiography (CCTA) has been widely used as a reliable imaging modality for assessing coronary artery disease (CAD). In addition, simultaneous left ventricular (LV) function analysis can be performed with retrospective electrocardiography (ECG) gated CT scanning, which acquires images throughout the entire cardiac cycle.[1] However, retrospective ECG-gated CCTA has inevitable drawback of relatively large radiation exposure, which carries a potential risk for cancer induction.

It is important to reduce the radiation exposure while preserving image quality, referring to the so-called 'as low as reasonably achievable'. To date, numerous studies have suggested strategies for radiation dose reduction, and one of them is lowering the tube voltage.[2] While it is definite that decreasing the tube potential is a powerful strategy to reduce the radiation dose of CCTA, there have been technical limitations of previous CT systems. Indeed, the maximum tube current they could generate at low tube potentials was insufficient, thus it was not always possible to provide adequate image quality, especially for obese patients.[3][4]

The recent introduction of third-generation dual-source CT (DSCT) system has raised expectations to overcome these issues. The major advantage of third-generation DSCT over second-generation DSCT system is a substantially higher tube current output at low tube voltages, enabling tube currents up to 1,300 mA each at 70 kV and 80 kV, respectively.[5][6] In addition, it allows short gantry rotation time with a temporal resolution up to 66 msec, which is another big strength for CCTA acquisition.[7]

In this issue of the *Journal of Cardiovascular Imaging*, Lee et al.[8] have shown the efficacy of third-generation DSCT for simultaneous evaluation of LV function and coronary artery status with an average radiation dose of 2.2 mSv. The results demonstrated fair to moderate agreement between CCTA and echocardiography for the LV function evaluation, including LV ejection fraction, LV end-diastolic and end-systolic volume. Bland-Altman analysis showed acceptable limits of LV function measured using CCTA, with echocardiography as a reference. Regarding

the difference in LV volume measured on CCTA and echocardiography, the authors listed several contributing factors, such as foreshortening of the LV apex, different approaches for LV volume calculation, and variable intrathoracic pressure. Although echocardiography has been widely used for cardiac function analysis with higher accessibility and rapidity, however, it has the inherent limitations of operator and patient dependency. On the other hand, CCTA is an operator-independent technique, and provided excellent inter-observer reliability for LV function analysis in current study. In addition, it enables simultaneous evaluation of CAD. Indeed, the result of present study demonstrated that the image quality for all of the 791 coronary artery segments were diagnostic.

For the achievement of radiation dose reduction, the authors applied automated attenuation-based tube voltage selection, ECG-based tube current modulation, and model-based iterative reconstruction, which were equipped on the 3rd-generation DSCT scanner. ECG-based tube current modulation (MinDose, Siemens Medical Solution) technique applies full dose during the selected range of R-R interval and otherwise only 4% of mAs for outside range, allowing for substantial radiation dose reduction nearly similar to that of prospective ECG-triggering technique. Moreover, model-based iterative reconstruction (advanced modeled iterative reconstruction, ADMIRE; Siemens Medical Solutions) is an advanced CT image reconstruction method, which has yielded numerous promising results for radiation reduction while preserving image quality.[9] There are several limitations in this study that should be mentioned, including small number of study population, evaluation of only two volumetric parameters of LV, and lack of assessment of diagnostic accuracy of CAD. However, this study has clinical implication that it showed the potential of CCTA as an alternative option for LV functional assessment with comparatively low radiation exposure. This study contributes to the growing body of literature on the efficiency of third-generation DSCT for CCTA acquisition.

The authors should expand this study with larger number of study population containing wide range of body mass index (BMI) and heart rate (HR). One of the interesting results of this study is that image quality of coronary arteries did not significantly differ according to the patients' HR, and even superior in patients with high BMI compared to those with low BMI. These are in contrast to previous studies suggesting high HR and BMI (patients' obesity) are main factors deteriorating image quality of CCTA.[10] Further studies are required to clearly address the role of third-generation DSCT for coronary imaging of patients with high HR and BMI.

Ultimately, CCTA is a unique modality enabling simultaneous evaluation of LV function and coronary artery status. This study could be one of the fundamental studies that broaden the spectrum of clinical utility of CCTA.

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