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Editorial

Glimpse of Relation between Imaging and Physiology

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▸ See the article "Lipid-Core Plaque Assessed by Near-Infrared Spectroscopy and Procedure Related Microvascular Injury" in volume 49 on page 1010.

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Coronary angiography remains the basic imaging modality to define the degree and extent of coronary atherosclerosis in clinical practice during diagnostic and therapeutic coronary intervention. However, the limitation of angiography is still frequently seen and is affected by technical limitations, operator versatility, and its poor visualization of the vessel wall. Furthermore, it provides limited information about the functional significance of the lesion. Today, intravascular ultrasound (IVUS), fractional flow reserve (FFR), and optical coherence tomography (OCT) are extensively used to overcome these limitations of conventional coronary angiography.

Near-infrared spectroscopy (NIRS) is routinely used to characterize chemical composition of biological tissue. The ability of NIRS to discriminate lipid-rich atherosclerotic plaque with high sensitivity and specificity in vitro provided the possibility that NIRS could be used to detect lipid-rich atheromas in vivo. The major limitation of NIRS is that it provides compositional, but not structural, information.[1] These limitations can be overcome with combination with grey-scale IVUS.[2] Several parameters have been introduced for the quantification of lipid presence in the scanned region. Among them, the lipid-core burden index (LCBI) defined as the fraction of yellow pixels on the chemogram multiplied by 1,000 is the essential parameter of NIRS which reflects lipid component and plaque vulnerability, and in this report LCBI is the main parameter of the NIRS.

Coronary microvascular dysfunction has been associated with angina and increased risk of major adverse cardiovascular events, including acute coronary syndrome, myocardial infarction, progressive congestive heart failure, and sudden cardiac death.[3-5] Coronary microvascular resistance is increasingly measured as a predictor of clinical outcomes, but there is no accepted gold-standard measurement. Among them, the recently introduced index of microcirculatory resistance (IMR) has been validated as a measure of microvascular resistance.[6] IMR has been shown to be independent of the presence of varying extents of coronary stenosis in a porcine model and humans, and it is also independent of FFR.[7]

In this issue of *Korean Circulation Journal*, Yang and colleagues[8] showed that post-percutaneous coronary intervention (PCI) IMR was higher (15.6±7.3 vs. 42.6±17.6 U, p<0.001) and post-PCI coronary flow reserve (CFR) was lower (3.7±2.2 vs. 2.1±1.0, p=0.029) in the high LCBI

group. They also showed Pre-PCI LCBI was positively correlated with post-PCI IMR (ρ=0.358, p=0.025) and negatively correlated with post-PCI CFR (ρ=−0.494, p=0.001). This report may be the first published data about the relation between imaging (NIRS focused) and physiology parameters of coronary microvascular dysfunction. Even though the relation is not so strong enough to produce clinical parameters differences such as cardiac enzyme or adverse cardiovascular outcome, this report showed some glimpse of relation between lipid core plaque by NIRS and microvascular abnormality.

Historically, there are many reports about the relationship between physiologic parameters and other intracoronary imaging modalities, but the results are not consistent. In the early day of these investigation, IVUS showed good correlation with FFR.[9] However, other reports revealed that the accuracy to predict significant FFR by minimum lumen area on IVUS was approximately 60% to 70%, which was considered unsatisfactory in clinical practice. Furthermore, the relation between IMR and IVUS parameters are not correlated with future event prediction.[10]

In the era of OCT, Usui and colleagues[11] also reported a higher IMR, a pure indicator of microvascular disease measured in the territory of the coronary artery with angiographically intermediate-to-severe lesions, is associated with increased prevalence of OCT-defined thin-cap fibroatheroma (TCFA), larger lipid volume index, and higher prevalence of subclinical plaque rupture.. Interestingly, both IMR and FFR were independent predictors of OCT-defined TCFAs.

The basic question related to all of intravascular modalities (IVUS, OCT, and NIRS) to detect vulnerable plaque is whether the results from the correlation study between imaging and physiologic parameters has some impact on the clinical outcome or clinical significance. Even though these correlation study could make some link between some parameters, atherosclerosis is mixture of all processes of continuous plaque disruption and healing, as evidenced by multiple layers inside plaque in autopsy studies so the link may not be translated directly into the cause and consequnces.[12]

Larger prospective studies of the natural history of coronary artery disease are warranted to determine the incremental prognostic value of epicardial coronary artery stenosis severity and microvascular dysfunction in combination with plaque vulnerability for clinical outcomes.

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