Research continues to search structural and functional features of coronary artery disease associated with cardiovascular outcomes

Due to the pandemic of obesity and type 2 diabetes mellitus, atherosclerotic cardiovascular disease, especially coronary artery disease (CAD) has become a major cause of death in developed countries. Recent guideline recommends the adoption of lipid-lowering therapy with more stringent low-density lipoprotein cholesterol (LDL-C) goals. However, atherosclerotic cardiovascular diseases still continue to occur, which associates with worse cardiovascular outcomes. This on-going cardiovascular risk suggests the need to better understand pathophysiology of atherosclerosis causing CAD.

Intravascular imaging modalities have contributed to providing mechanic insights into how percutaneous coronary intervention (PCI) dilates coronary lesions and why restenosis occurs. In addition, this imaging tool has revealed mechanism behind the formation, progression, and instability of coronary atherosclerosis *in vivo*. In particular, following the development of high-resolution novel imaging modalities such as optical coherence tomography and near-infrared spectroscopy imaging, our understanding about atherosclerosis has been further deepened. Since 2004, intravascular imaging modality has been employed to investigate the efficacy of novel anti-atherosclerotic agents on coronary atherosclerosis (1,2). While this invasive plaque imaging enables to visualize the quantity and quality of coronary atherosclerosis, non-invasive ones also have abilities to evaluate the degree of coronary atherosclerosis. Multi-slice computed tomography has become an important non-invasive imaging modality to elucidate anatomical features of coronary arteries. Recent studies showed that multi-slice computed tomography evaluates inflammation activity, plaque quality, and coronary physiology. Magnetic resonance imaging (MRI) also has a potential to visualize high-risk plaques. Noguchi *et al.* reported high-intensity plaque on non-contrast T1 MRI predicted future coronary events (3). As such, evidence from plaque imaging tools is expected to help us to evaluate structural features which affects clinical outcomes in patients with CAD.

Recently, considerable interests have focused on coronary physiology for evaluation of myocardial ischemia, indication of revascularization, and risk stratification of future cardiac events. Several randomized controlled clinical trials demonstrated that fractional flow reserve (FFR)-guided PCI was safe and effective to appropriately select patients who require revascularization or medical therapy alone. Then, a variety of physiological measures including resting index has been developed and shown to detect myocardial ischemia. While wire-based FFR is an invasive approach, recent technical advancement has enabled to non-invasively evaluate FFR by computed tomography. This indicates that physiological evaluation will be clinically more applicable in the future. Mechanistically, coronary lesions exhibiting abnormal coronary physiological feature have been reported to harbor more vulnerable plaque features by plaque imaging analysis (4). These observations support that both morphological and functional features synergistically associate with pathophysiology of CAD. Therefore, considering of these two features will be increasingly important to evaluate nature of atherosclerosis and adopt appropriate therapeutic management. The current review will introduce the latest topics about structural and functional evaluation of CAD.

References

1. Nicholls SJ, Kataoka Y, Nissen SE, et al. Effect of Evolocumab on Coronary Plaque Phenotype and Burden in Statin-Treated Patients Following Myocardial Infarction. JACC Cardiovasc Imaging 2022;15:1308-21.
2. Kataoka Y, Kitahara S, Funabashi S, et al. The effect of continuous glucose monitoring-guided glycemic control on progression of coronary atherosclerosis in type 2 diabetic patients with coronary artery disease: The OPTIMAL randomized clinical trial. J Diabetes Complications 2023;37:108592.
3. Noguchi T, Yamada N, Higashi M, et al. High-intensity signals in carotid plaques on T1-weighted magnetic resonance imaging predict coronary events in patients with coronary artery disease. J Am Coll Cardiol 2011;58:416-22.
4. Murai K, Kataoka Y, Nicholls SJ, et al. The Residual Lipid-Rich Coronary Atheroma Behind the Implanted Newer-Generation Drug-Eluting Stent and Future Stent-Related Event Risks. Can J Cardiol 2022;38:1504-15.

Yu Kataoka, MD, PhD, FACC, FAHA, FESC, FJCC, FJCA
Department of Cardiovascular Medicine, National Cerebral & Cardiovascular Center, Osaka, Japan