Computed tomographic predictors of a lipid-rich plaque identified by near-infrared spectroscopy

T. Nagamine¹, E. Usui¹, M. Hoshino¹, M. Hada¹, Y. Hanyu¹, H. Ueno¹, K. Nogami¹, K. Matsuda¹, K. Sayama¹, T. Sakamoto¹, T. Yonetsu², T. Sasano², T. Kakuta¹

¹Tsuchiura Kyodo General Hospital, Ibaraki, Japan
²Tokyo Medical And Dental University, Department of Cardiovascular Medicine, Tokyo, Japan

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Background: In a phase of primary prevention, individuals with high coronary calcium scores (CACS) assessed by computed tomographic coronary angiography (CTCA) are known to be associated with higher risk of atherosclerotic cardiovascular disease. However, clinical significance of CACS in patients requiring revascularization and its relevance to lipid core burden remains unknown.

Purpose: This study aimed to examine the relationship between lipid components assessed by near-infrared spectroscopy (NIRS) and coronary artery calcium score (CACS) assessed by preprocedural CTCA imaging. We also aimed to investigate CTCA-derived predictors of target vessels with high lipid core burden.

Methods: Consecutive patients who underwent preprocedural CTCA imaged within 3 months before elective NIRS-intravascular ultrasound-guided percutaneous coronary intervention (PCI) for de novo lesions in 1 coronary artery were included. Patients who had undergone stent deployment before inclusion were excluded. Target vessels requiring lesion modification such as balloon inflation or debulking before NIRS imaging were also excluded. Lipid rich plaque (LRP) was defined as a target lesion with maximum LCBI in 4 mm (maxLCBI4mm) >500. Clinical demographics, angiographic, and CTCA-derived morphological findings were compared between target vessels with versus without LRP.

Results: A total of 95 target vessels in 95 patients were evaluated for the final dataset. NIRS identified 25 LRP and 70 non-LRP. Clinical demographics and angiographic findings showed no significant differences between vessels with versus without LRP. On CTCA, prevalence of high-risk plaque (HRP) that contains two or more of napkin-ring sign, positive remodeling, low attenuation plaque and spotty calcification at the target vessel was significantly higher in LRP group (56.0% vs. 25.7%, P=0.01). Target vessel CACS and total amount of 3-vessel CACS tended to be higher in patients with LRP than those without LRP (282 [124-479] vs. 114 [25-248], P=0.01; 882 [233-1501] vs. 308 [99-753], P=0.01, respectively). Multivariate logistic regression analyses to predict LRP at the target vessel revealed that the presence of HRP (odds ratio [OR] 3.52, 95% confidence interval [CI] 1.28-9.69, P=0.01) and higher 3-vessel CACS (per 100, OR 1.09, 95% CI 1.03-1.16, P <0.01) were independently predictive of LRP.

Conclusions: Preprocedural CTCA-derived high-risk plaque and total amount of 3-vessel CACS were independent predictors of LRP defined by NIRS.