Characterization of plaque features exhibiting physiological mismatch between fractional flow reserve and resting index: near-infrared spectroscopy imaging analysis

K. Murai[1], Y. Kataoka[1], H. Hosoda[1], T. Nakashima[1], S. Honda[1], M. Fujino[1], K. Nakao[1], S. Yoneda[1], F. Otsuka[1], K. Nishihira[2], T. Kanaya[3], Y. Asaumi[1], T. Noguchi[1], S. Yasuda[1]

[1]National Cerebral and Cardiovascular Center, Department of Cardiovascular Medicine, Osaka, Japan; [2]Miyazaki Medical Association Hospital, Department of Cardiology, Miyazaki, Japan; [3]Dokkyo Medical University, Department of Cardiovascular Medicine, Mibu, Japan

Funding Acknowledgement: Type of funding source: None

Background: In addition to fractional flow reserve (FFR), resting indexes (RI) have been shown as another physiological measure to evaluate myocardial ischemia. Despite the clinical usefulness of RI without the use of intravenous vasodilatory agent, discrepancy between FFR and RI infrequently occurs. Whether this physiological mismatch is derived by specific plaque feature remains unknown.

Purpose: To characterize coronary plaques associated with coronary physiological mismatch.

Methods: We analyzed 59 coronary arteries (LAD/RCA/LCX=49/4/6) with FFR≤0.80 in 57 stable CAD subjects receiving PCI. Following measurement of FFR and RI, culprit lesion was evaluated by near-infrared spectroscopy and intravascular ultrasound (NIRS/IVUS). The analyzed vessels were stratified according to FFR and RI values: FFR≤0.75+RI>0.89 (n=6: physiological mismatch), FFR>0.75+RI>0.89 (n=6), FFR≤0.75+RI≤0.89 (n=33) and FFR>0.75+RI≤0.89 (n=14).

Results: The median values of percent diameter stenosis, FFR and RI were 51%, 0.75 and 0.87, respectively. Physiological mismatch was observed in 10.1% (=6/59) of analyzed vessels. On IVUS imaging, maximum percent plaque area was greater than 70% in all groups (p=0.29). Furthermore, there were no significant differences in angiographic and IVUS-derived minimum lumen area across 4 groups (Table). However, culprit lesions exhibiting physiological mismatch contained a substantially larger amount of lipid plaque, reflected by a higher maximum 4-mm lipid-core burned index (maxLCBI4mm: p=0.04) on NIRS imaging (Table). Multivariate analysis demonstrated maxLCBI4mm as the only plaque feature associated with physiological mismatch (odds ratio=1.010, 95% CI: 1.001–1.019, p=0.02).

Conclusion: Plaque feature associated with coronary physiological mismatch was the extent of lipidic materials but not the quantity of coronary atheroma. Since the accumulation of lipidic plaque component is caused by endothelial dysfunction, this vascular substrate could impair baseline vasomotion, thereby causing a lower FFR despite preserved RI value. Evaluation of lipidic burden may be a potential option to avoid unnecessary deferral of revascularization in subjects with normal RI value.

Angiogram and plaque quantity analysis

	FFR≤0.75 RI>0.89 (n=6)	FFR>0.75 RI>0.89 (n=6)	FFR≤0.75 RI≤0.89 (n=33)	FFR>0.75 RI≤0.89 (n=14)	p value
Left anterior descending artery, n (%)	5 (83%)	3 (50%)	30 (91%)	11 (79%)	0.10
Percent diameter stenosis (%)	49.7±6.9	54.3±3.4	49.9±1.9	52.4±2.7	0.76
Minimum lumen area (mm^2)	2.1 (1.4–2.7)	1.7 (1.5–2.0)	1.7 (1.5–2.5)	2.1 (1.6–2.5)	0.21
Maximum percent plaque area (%)	85.0±1.9	81.7±2.6	82.2±1.1	79.7±1.2	0.29

FFR = fractional flow reserve, RI = resting indexes.