

Optical Coherence Tomography Findings of High-Risk Plaques on Coronary Computed Tomography Angiography

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Disclosure

- The authors have no financial conflicts of interest to disclose concerning the presentation.

Background

- Noninvasive evaluation of rupture-prone coronary plaques has been done primarily by coronary computed tomography angiography (CTA).

Kashiwagi et al. JACC img 2009

- High-risk plaque (HRP) on CTA is considered equivalent to vulnerable plaque.

Background

- HRP on CTA is implicated as predictive of acute coronary events.

Michelle C et al. JACC 2019
Williams MC JACC 2019

- However, absolute differences in event rates between patients with and without HRP are small.

Motoyama S. et al. JACC 2015
Ferencik M. et al. JAMA Cardiol 2018

- The detailed plaque morphology of each HRP component has not been systematically validated against high-resolution imaging modalities.

The aim of the study

To correlate HRP features on CTA with plaque characteristics on OCT

Method

- Patients with CAD who underwent both CTA and OCT imaging prior to PCI were included from the “Massachusetts General Hospital and Tsuchiura Kyodo General Hospital Coronary Imaging Collaboration” database (NCT04523194).
- All CTA and OCT images were submitted to the core laboratory at Massachusetts General Hospital and analyzed by two independent investigators who were blinded to patients’ data.

Method

CTA analysis

- Positive remodeling (PR)
- Low-attenuation plaque (LAP)
- Napkin-ring sign (NRS)
- Spotty calcification (SC)

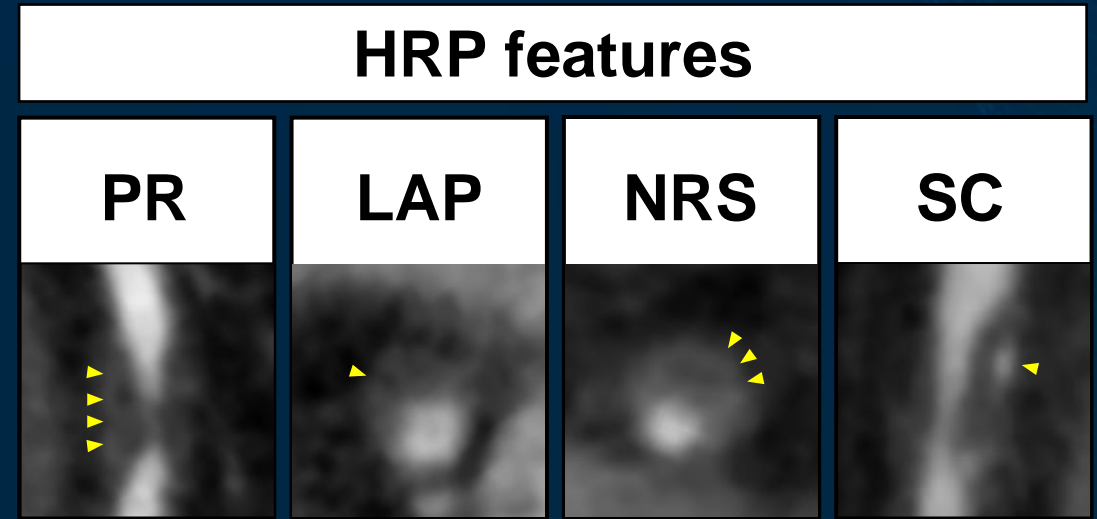
OCT analysis

Qualitative analysis:

Lipid-rich plaque, thin-cap fibroatheroma (TCFA), macrophage, microvessels, cholesterol crystal, and layered plaque

Quantitative analysis:

Maximum lipid arc, lipid-index, macrophage grade, and %AS



Study Flow Chart

1492 lesions were detected in 457 culprit vessels on CTA

417 lesions with unanalyzable OCT images

1075 lesions in 448 patients with both OCT and CTA

Baseline characteristics

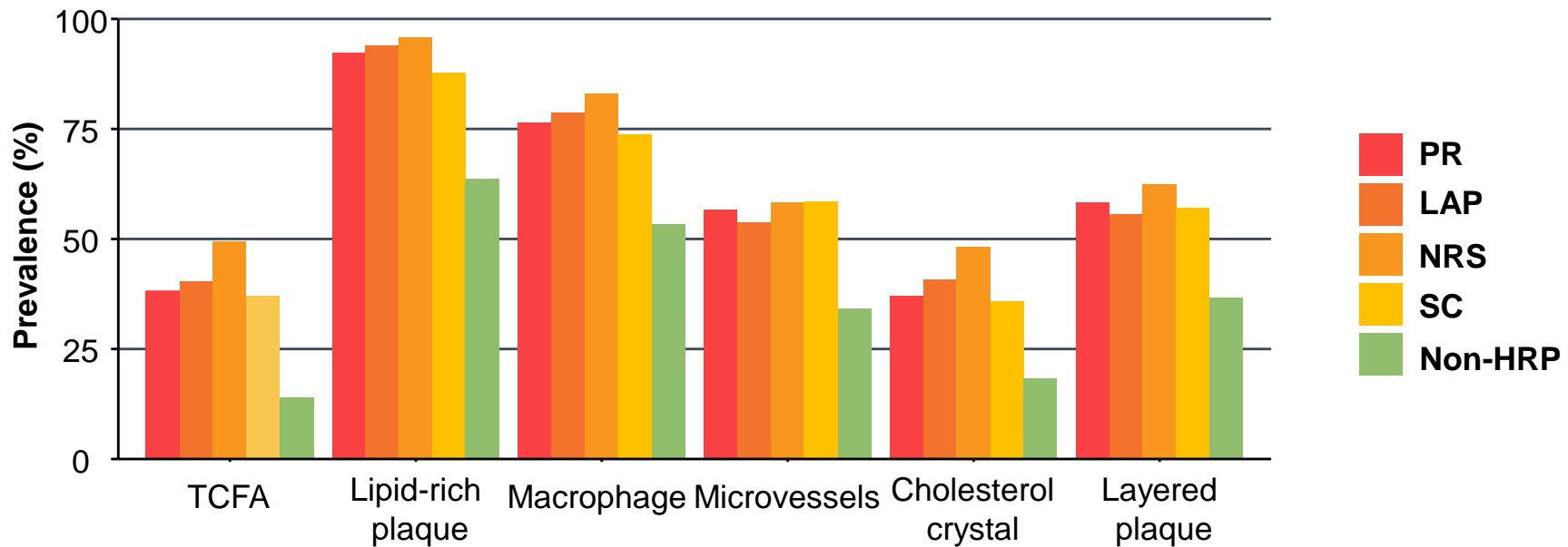
	All (n=448)
Age, median (IQR), years	67 (59-74)
Male, No (%)	357 (79.7)
Body mass index, median (IQR), kg/m ²	24.7 (22.5-26.6)
Clinical presentation, No (%)	
CCS	245 (54.7)
UAP	48 (10.7)
NSTEMI	155 (34.6)
Risk factors, No (%)	
Hypertension	265 (59.2)
Hyperlipidemia	259 (57.8)
Diabetes mellitus	182 (40.6)
Chronic kidney disease	131 (29.2)
Current smoker	131 (29.2)
prior PCI, No (%)	78 (17.4)

Baseline characteristics (continued)

	All (n=448)
Laboratory data, median (IQR)	
LDL-C, mg/dL	103 (83-129)
HDL-C, mg/dL	46 (40-56)
Triglyceride, mg/dL	123 (85-182)
HbA1c, %	5.9 (5.6-6.6)
eGFR, mL/min/1.73 m ²	72 (62-83)
Time from CTA to OCT, median (IQR), days	8 (0-40)
Medication before PCI, No (%)	
P2Y12 inhibitor	144 (32.1)
Aspirin	181 (40.4)
ARB/ACEi	276 (61.6)
β-blocker	159 (35.5)
Statin	227 (50.7)

The prevalence of OCT features of plaque vulnerability amongst HRP features

	PR	LAP	NRS	SC	Non-HRP
TCFA	38.1%*	40.3%*	49.4%*	37.0%*	14.0%
Lipid-rich plaque	92.2%*	93.8%*	95.9%*	87.7%*	63.6%
Macrophage	76.5%*	78.6%*	82.9%*	73.7%*	53.2%
Microvessels	56.6%*	53.8%*	58.2%*	58.5%*	34.1%
Cholesterol crystal	37.0%*	40.8%*	48.2%*	35.7%*	18.2%
Layered plaque	58.2%*	55.6%*	62.4%*	57.0%*	36.7%

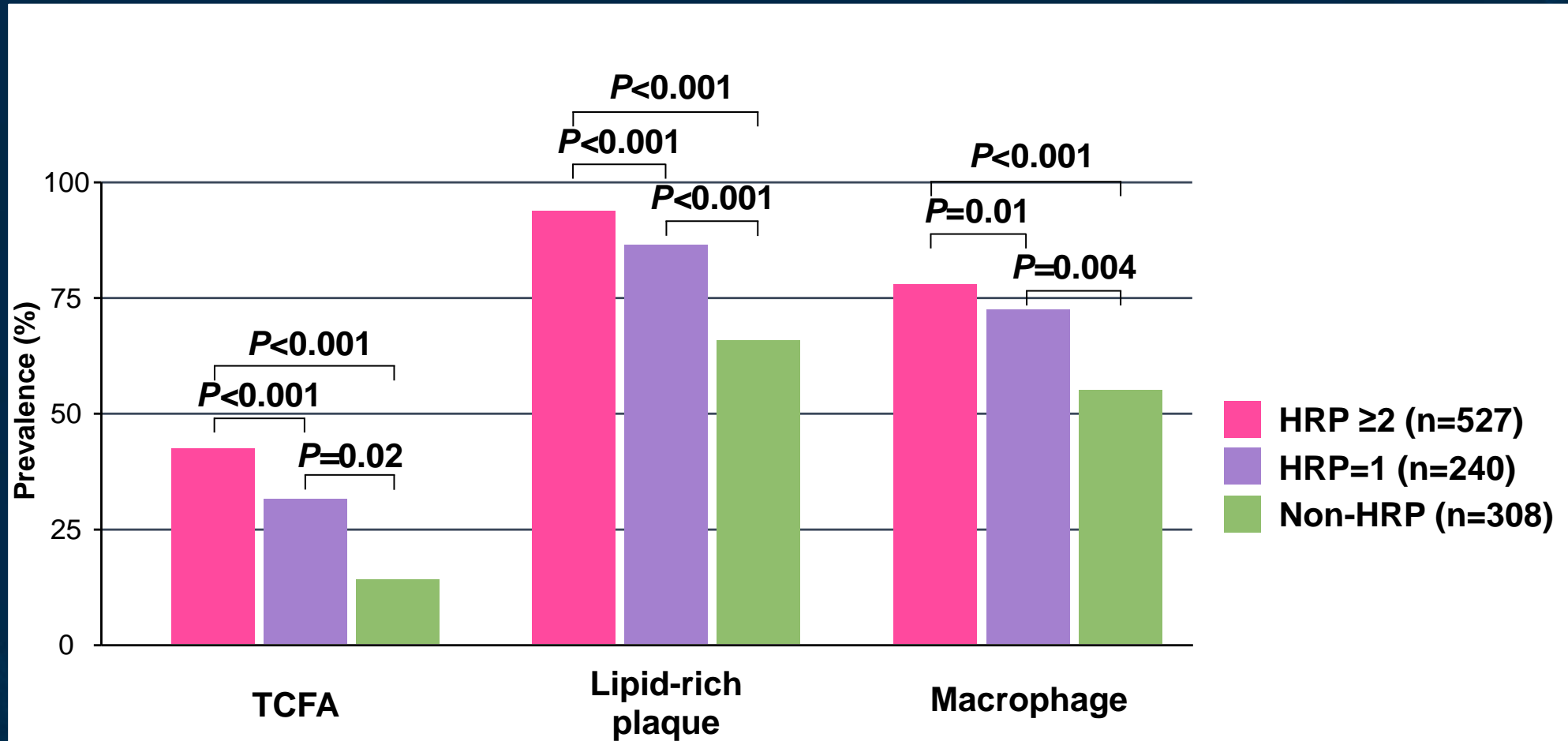


* indicates $P < 0.001$ vs. Non-HRP.

CTA-detected lesion characteristics

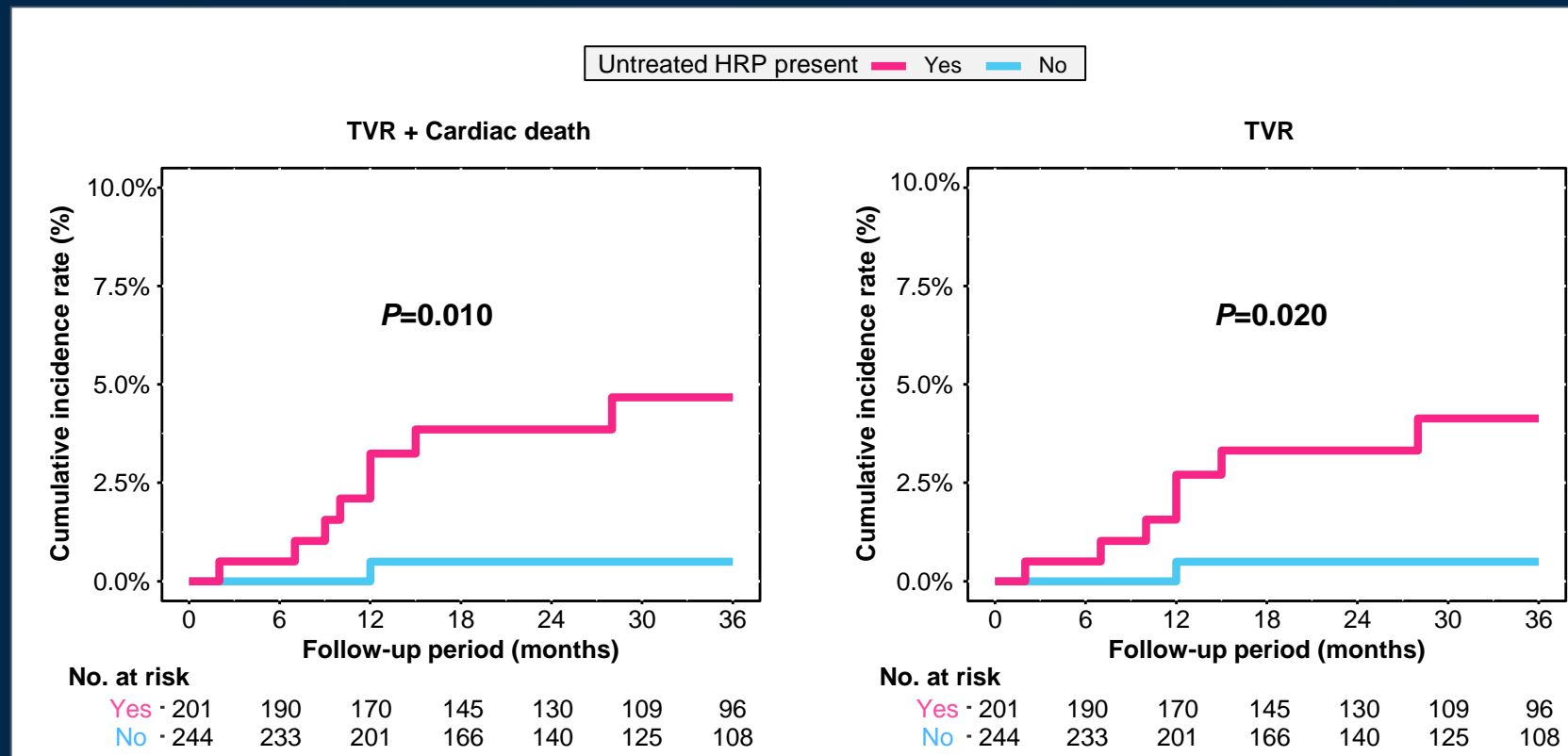
	HRP \geq 2 (n=527)	HRP=1 (n=240)	Non-HRP (n=308)
HRP feature, No (%)			
PR	516 (97.9)	109 (45.4)	0 (0.0)
LAP	413 (78.4)	26 (10.8)	0 (0.0)
NRS	167 (31.7)	3 (1.2)	0 (0.0)
SC	312 (59.2)	102 (42.5)	0 (0.0)
Plaque location, No (%)			
LAD	299 (56.7)	114 (47.5)	170 (55.2)
LCX	50 (9.5)	34 (14.2)	43 (14.0)
RCA	133 (25.2)	59 (24.6)	57 (18.5)
Left main	25 (4.7)	24 (10.0)	31 (10.1)
Others	20 (3.8)	9 (3.8)	7 (2.3)

OCT findings based on the number of HRP features



Tukey's honest significant different correction was used for the multiple comparisons.

Cumulative incidence rate of cardiac events between patients with untreated HRP and those without



The comparisons of cumulative incidences of TVR and the composite outcome of TVR and cardiac death between patients with untreated HRP and those without were conducted by Gray's test, accounting for competing risks with all-cause death.

Summary

- All HRP features, including PR, LAP, NRS, and SC, were associated with a higher prevalence of OCT features of plaque vulnerability.
- Although the prevalence of OCT features was similar among the 4 HRP features, TCFA, lipid-rich plaque and macrophage became more prevalent as lesions exhibited more HRP features.
- HRP in a culprit vessel was associated with a higher incidence of repeat revascularization and cardiac death at a 3-year follow-up.

Conclusion

- HRP features on CTA were associated with OCT features of plaque vulnerability.
- Patients with HRP have a higher incidence of major cardiac events (TVR + cardiac death).