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POSITRON EMISSION TOMOGRAPHY TO IDENTIFY RUPTURED AND VULNERABLE CORONARY PLAQUES

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Background Non-invasive imaging to identify vulnerable or ruptured coronary artery plaque would represent a major clinical advance. Using positron emission tomography (PET) and computed tomography (CT), we investigated coronary uptake of ^{18}F -fluoride (^{18}F -NaF) and ^{18}F -fluorodeoxyglucose (^{18}F -FDG) in patients with acute myocardial infarction or stable angina.

Methods Forty patients with acute myocardial infarction and 40 with stable angina underwent electrocardiogram-gated ^{18}F -NaF and ^{18}F -FDG PET-CT and invasive coronary angiography. ^{18}F -NaF uptake was compared with virtual histology intravascular ultrasound in patients with stable angina, and with histology in 12 carotid endarterectomy specimens.

Results Intense focal ^{18}F -NaF uptake occurred at the site of plaque rupture in 37 (93%) patients with myocardial infarction (tissue-to-background ratio [TBR], 1.66 [1.40–2.25] versus 1.24 [1.06–1.38]; culprit versus maximal non-culprit, $P < 0.001$). In patients with stable angina, 18 (45%) had focal plaque ^{18}F -NaF uptake (2.10 [1.71–2.81]) that, compared to plaques without uptake, had more high-risk features: positive remodeling (vessel area 24 [17–27] versus 14 [12–18] mm²; $P = 0.002$), necrotic core (24.6% [20.5–28.8] versus 18.0% [14.0–22.4], $P = 0.001$) and microcalcification (73 versus 21%, $P = 0.002$). Carotid plaque rupture also co-localized with ex vivo ^{18}F -NaF uptake and was associated with areas of apoptosis, necrosis and active calcification. Myocardial uptake markedly hampered ^{18}F -FDG assessment in most patients (55%) and even where coronary uptake was discernible, there were no differences between culprit and non-culprit lesions (1.71 [1.40–2.13] versus 1.58 [1.28–2.01]; $P = 0.34$).

Conclusions ^{18}F -NaF holds major promise as a novel biomarker of coronary plaque vulnerability and rupture with implications for the diagnosis, investigation and treatment of coronary artery disease.