British Nuclear Cardiology Society (BNCS) commentary on:

This interesting study in the *Lancet* by researchers at the University of Edinburgh and the Edinburgh Heart Centre is the first of its kind which has prospectively evaluated the role of integrated positron emission tomography (PET)/computed tomography (CT) with the PET tracer, ¹⁸F-fluoride (NaF), in patients with stable and unstable coronary artery disease.

Forty patients with acute myocardial infarction (MI) and 40 patients with stable angina were recruited. There were some important exclusion criteria, including patients less than 50 years of age, insulin-dependent diabetes and renal failure. In addition to ¹⁸F-NaF PET/CT, patients also underwent PET/CT imaging with the glucose analogue, ¹⁸F-FDG. In the patients with acute MI, 93% (37/40) ruptured or culprit coronary artery plaques showed significantly higher ¹⁸F-NaF uptake than non-culprit lesions (median target-to-background ratio of 1.66 vs. 1.24, p <0.0001). In three patients the ruptured plaque did not show increased ¹⁸F-NaF uptake, and in five patients, increased uptake was seen at multiple sites within the coronary vasculature. In patients with stable angina, focal ¹⁸F-NaF coronary uptake was seen in 45% (18/40), with many showing multivessel uptake. Of these, 72% were non-obstructive on x-ray coronary angiography but more commonly showed high-risk features on intravascular coronary ultrasound and coronary CT, compared to plaques with no uptake (positive remodeling, microcalcification and necrotic core). With ¹⁸F-FDG imaging, in both the acute and stable patients between 45-52% of coronary vascular territories could not be evaluated, and only 6/40 patients with acute MI showed increased uptake in the culprit coronary plaque, suggesting that ¹⁸F-FDG imaging is unlikely to have a significant role in evaluating coronary artery plaques. A small group of patients with symptomatic carotid artery atheroma undergoing carotid endarterectomy (CEA) were also studied with ¹⁸F-NaF PET/CT; *ex vivo* PET/CT was performed on the intact specimen in nine cases, and histological analysis showed that increased focal uptake was present at the site of ruptured carotid plaque in all cases.

This study has shown that ¹⁸F-NaF PET/CT can identify the ruptured coronary artery plaque in the majority of patients with acute MI in a study cohort of 40 patients in a single-centre. The study also shows that ¹⁸F-NaF coronary uptake in patients with stable angina is associated with coronary plaques that show high-risk features on intravascular coronary ultrasound and CT. These results are promising in that they suggest that ¹⁸F-NaF imaging may allow the
identification of coronary artery plaques that are at risk of rupture. However, this requires further work, preferably in large multicenter and collaborative studies with long-term follow-up and patient outcome data. If such a non-invasive test can be shown to be reliable and reproducible in identifying the ‘at-risk’ coronary artery lesion in patients who have not yet suffered an acute coronary event, it would hold considerable promise for improving how patients with coronary heart disease are identified and managed, potentially opening the way to more targeted and personalized treatment strategies.

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