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Reply

We thank Dr. Sharma for the interest in our paper (1) and the recognition of our work as "a welcome step in the ongoing search for one-stop cardiac imaging modality." Dr. Sharma highlights some of the advantages and limitations of our approach and focuses on several points that merit discussion.

How did computed tomography perfusion (CTP) and cardiac magnetic resonance myocardial perfusion imaging (CMR-Perf) perform among patients with multivessel disease (MVD) or high-grade stenosis? A significant proportion of our patients (n = 20) had MVD as assessed by fractional flow reserve (FFR). In this subgroup, CMR-Perf and integrative multidetector computed tomography integrated protocol (MDCT-IP) had similar sensitivity (95%) and performed better than isolated CTP (65%). In patients with MVD as assessed by quantitative coronary angiography (QCA) (n = 23), CMR-Perf achieved a per-vessel accuracy of 80% (sensitivity = 77%; specificity = 86%) performing better than CTP (accuracy = 58%; sensitivity = 44%; specificity = 90%). In patients with stenoses $\geq$70% on QCA (n = 44), CMR-Perf was also superior, with a per-vessel accuracy of 87%, sensitivity of 81%, and specificity of 94% (vs. 71%, 55%, and 89% for CTP, respectively). Nevertheless, CTP specificity was very important for MDCT-IP per-vessel performance in these subgroups (accuracies of 68% and 75%, respectively) as computed tomography angiography classified almost all these vessels as either "significant disease" or "unevaluable."

Could the false positive CTP be rather misclassifications in the setting of nonobstructive coronaries due to thrombus recanalization or post-percutaneous coronary intervention (PCI)? Following the study protocol, patients with known coronary artery disease, including previous infarction and PCI, were excluded and only the areas with reversible hypoperfusion were classified as positive. While perfusion defects at rest and stress were found in 16 patients, all of these corresponded to scar (confirmed by late gadolinium enhancement) and were not considered as a marker for functionally significant coronary artery disease to avoid "an incorrect label of false positive" in comparison with a functional standard.

While we acknowledge that FFR was only determined in stenosis >40% and that occasionally abnormal FFR can be found in vessels with lesser degree of narrowing, this is rare. Similarly, no FFR was performed in patients with subocclusive stenoses or with tortuous/calcified/complex lesions, which may induce some remaining level of inaccuracy. The use of a functional reference is an important improvement compared to the vast majority of published studies. However, FFR is not an optimal reference standard, as it does not account for the amount of ischemic burden. We also recognize overlap of segments between coronary territories when a segment-based analysis is used. Having this in consideration, per-vessel analysis was performed assigning the perfusion segments to the corresponding vascular territory, as assessed by invasive coronary angiography.

Finally, we support Dr. Sharma's statement emphasizing the need for designated CTP software and substantial expertise for image interpretation, which is still time consuming and observer dependent. Radiation exposure and the need for medication for computed tomography angiography are other important limitations for a generalized use of MDCT-IP. Nevertheless, simultaneous morphologic and functional analysis is already possible, as we have shown using a single-source 64-slice generation scanner.

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Comparison of Cardiac Magnetic Resonance and Computed Tomography Stress-Rest Perfusion Imaging for Detection of Coronary Artery Disease

In their recent paper, Dr. Bettencourt and colleagues (1) report similar accuracy for the detection of coronary artery disease (CAD) between cardiac magnetic resonance (CMR) perfusion and an integrated computed tomography (CT) perfusion/angiography protocol.

Unfortunately, the authors did not interpret their CMR images in the standard way (2,3), which may limit the applicability of their findings. They state that only areas with ischemia on CMR perfusion imaging were regarded as positive for CAD and that patients with late gadolinium enhancement (LGE) scar but no additional ischemia were classified as negative for CAD. Thus, patients with infarction and an occluded or severely stenotic supplying vessel would be incorrectly classified as having no CAD by their CMR protocol. For this reason, areas of LGE in an infarct pattern are typically interpreted as demonstrating the presence of CAD (2,3). Because ~16% of the patients in this study had LGE in an infarct pattern, it would be useful to know the diagnostic performance of CMR if standard interpretation of LGE were used.