Letter to the editor: “A novel angiographic fractional flow reserve”

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TO THE EDITOR: We read with great interest the article “Quantification of absolute coronary flow reserve and relative fractional flow reserve in a swine animal model using angiographic image data,” published in the American Journal of Physiology-Heart and Circulatory Physiology (5). Fractional flow reserve (FFR) is an epicardial lesion-specific parameter to determine the functional coronary stenosis, which is determined by pressure difference and resistance (1–3). Specifically, Molloi and colleagues (5) present a novel angiography-derived FFR (FFRa) computed from blood flow (Qa) through the time-density curve based on the first-pass analysis technique. Accordingly, relative FFRa was calculated as the ratio of the normalized Qa in left anterior descending to the left circumflex artery during hyperemia. Relative FFRa correlated linearly with quantitative flow probe-based FFR (FFRq) (relative FFRa = 0.86 FFRq + 0.05; r = 0.90; P < 0.0001) (5).

Pressure-wire derived FFR is a well-established hemodynamic index to assess the ischemic severity of stenosis and the necessity for cardiac revascularization (1, 2). However, the risk of crossing the lesion and high cost of pressure wire greatly restrict its clinical application (5; and X. Qi, H. Lv, F. Zhou, J. Zhao, J. Xu, L. Xiang, F. Wang, Q. Zhan, J. Jiang, J. Xiao, unpublished observations). We are excited about the novel FFRa technique developed by Molloi and colleagues, which has potential to provide functional assessment during routine cardiac catheterization without a need to cross a stenosis with a pressure wire.

However, the study is not without limitations. First, this pilot study investigated only fifteen swine. This small sample size limits reliability, and thus the equation for relative FFRa and FFRq should be further validated with a large sample size. Second, Molloi and colleagues gradually injected microspheres into the left anterior descending artery to create microvascular disruption, and then an occluder was used to produce stenosis. Therefore, the model of coronary stenosis is greatly different from that in pathological changes. Specially, the elasticity of arterial wall in lesion-specific condition may greatly influence the cardiac perfusion pressure, which was improperly ignored in FFRa calculation. Additionally, improved access techniques and safety of pressure wire-derived FFR make it as a hemodynamic gold standard of coronary stenosis (1–3). Therefore, it should be a significant comparison technology beyond FFRq.

Finally, relative FFRa is still considered as an invasive technique, although it is obtained without a pressure wire crossing the lesion. Peebles (4) summarized the significant publications of 2012 in cardiac imaging, particularly in the modalities of cardiac computed tomography (CT). A noninvasive CT-derived FFR (FFRCT), which uses three-dimensional modeling, finite element analysis, and computational fluid dynamics, is an alternative approach to assessing the functional significance of a coronary stenosis (1, 2, 4; and X. Qi, H. Lv, F. Zhou, J. Zhao, J. Xu, L. Xiang, F. Wang, Q. Zhan, J. Jiang, J. Xiao, unpublished observations). A series of well-designed multicenter international clinical studies demonstrated the diagnostic performance of FFRCT with invasive FFR as the reference standard (1, 2). Therefore, it is strongly suggested making a comparison of FFRa with FFRCT before its use from bench to bedside.

REFERENCES

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