Commentary on "Application of Apical Myocardial Perfusion Quantitative Analysis by Contrast Enhanced Ultrasound utilizing High-Frequency Linear Probe"

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Abstract

We are grateful to the authors for sharing the results of this very precise and detailed analysis of the diagnostic performance of apical myocardial perfusion by combining high-frequency linear probe and contrast enhanced ultrasound (CEUS) for the detection of left anterior descending artery (LAD) stenosis. there are many imaging modalities to assess coronary artery stenosis. For example, invasive coronary angiography, coronary computed tomography angiography (CCTA), myocardial nuclear perfusion imaging, cardiac magnetic resonance (CMR)[1], it's crucial to choose the most appropriate imaging modality for diagnosis, treatment and procedural planning. In previous studies, the quantitative analysis of myocardial perfusion by CEUS were based on 17-segment model to assess the stenosis of the relevant vessels[2], it is relatively cumbersome to perform. Since most of the apical LV is supplied by LAD, the authors quantitative analysis of myocardial blood flow in the apical LV to evaluate the stenosis of the LAD vessels by combining high-frequency linear probe and CEUS, overcoming insufficient near-field resolution and artifacts by the conventional phased-array probe. The authors found that it is feasible and convenient to to assess apical perfusion to reflect LAD stenosis by combining high-frequency linear probe and CEUS with high Area under the curve of β, T, A, and MBF (0.880, 0.881, 0.761, and 0.880 respectively). And the best cut-off of β, T, A, and MBF were 10.32, 3.28, 9.39, and 4.99 respectively. What is more, compared with phased-array probe, the quantitative analysis of high-frequency linear probe is of high reproducibility and could get good curve fitting

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Keywords: Apical Myocardial Perfusion, Contrast-Enhanced Ultrasound, High-Frequency Linear Probe Microvascular Perfusion

A Commentary on

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by Ruohan Zhao et al

We are grateful to the authors for sharing the results of this very precise and detailed analysis of the diagnostic performance of apical myocardial perfusion by combining high-frequency linear probe and contrast enhanced ultrasound (CEUS) for the detection of left anterior descending artery (LAD) stenosis. there

are many imaging modalities to assess coronary artery stenosis. For example, invasive coronary angiography, coronary computed tomography angiography (CCTA), myocardial nuclear perfusion imaging, cardiac magnetic resonance (CMR)[1], it's crucial to choose the most appropriate imaging modality for diagnosis, treatment and procedural planning. In previous studies, the quantitative analysis of myocardial perfusion by CEUS were based on 17-segment model to assess the stenosis of the relevant vessels[2], it is relatively cumbersome to perform. Since most of the apical LV is supplied by LAD, the authors quantitative analysis of myocardial blood flow in the apical LV to evaluate the stenosis of the LAD vessels by combining high-frequency linear probe and CEUS, overcoming insufficient near-field resolution and artifacts by the conventional phased-array probe. The authors found that it is feasible and convenient to to assess apical perfusion to reflect LAD stenosis by combining high-frequency linear probe and CEUS with high Area under the curve of β, T, A, and MBF (0.880, 0.881, 0.761, and 0.880 respectively). And the best cut-off of β, T, A, and MBF were 10.32, 3.28, 9.39, and 4.99 respectively. What is more, compared with phased-array probe, the quantitative analysis of high-frequency linear probe is of high reproducibility and could get good curve fitting (R2=0.29 vs. R2=0.71, P<0.01). We acknowledge the precise nature of the work. However, we would like to raise some points that may be worthwhile considering.

1. This study enrolled 91 patients who complained about chest pain, clinical diagnoses include angina, unstable angina and myocardial infarction, the criminal artery was LAD, which confirmed by invasive coronary angiography. To my opoin, the apical myocardial perfusion could be affected by other factors, such as the site and degree of LAD stenosis, distal blood flow and whether acute occlusion of LAD, chronic occlusion with or without collateral circulation[3]. Thus, it may question the accuracy of evaluating apical myocardial perfusion to address LAD stenosis. Previous study demonstrated that Quantitative intravenous MCE has the potential to estimate physiologic severity of the LAD stenosis in the clinical setting by comparing the results with those of exercise thallium-201 single-photon emission computed tomography (SPECT), according to redistribution in the LAD territories with SPECT or not, which elimination of the effects of the above factors[4]. With this in mind, it could be better if group with LAD stenosis manifest as LAD fixed stenosis without collateral circulation and other coronary artery stenosis. Thus, the apical myocardial perfusion may have close relation with LAD stenosis, which can optimize design solutions to eliminate impact bias of apical myocardial perfusion.
2. In this study, High-Frequency Linear Probe was used creatively to assess myocardial blood flow in the apical region of the heart, which improved the quality of the images and the accuracy of the analysis[5]. However, due to the limitations of the High-Frequency Linear Probe, it is not capable of assessing myocardial blood flow in other cardiac segments. And, in actual clinical practice, we do not know what the patient's crime vessel is, and blindly assessing myocardial blood flow in the apical region alone has some limitations for clinical guidance. It greatly limits its clinical application for the management of patients with suspected or known other coronary artery disease (CAD).
3. However, it may add potential value for the quantitatively assessment of microvascular perfusion (MVP) for myocardial infarction in patients with anterior wall myocardial infarction[6]. For patients with extensive anterior wall myocardial infarction, the infarct-related artery (IRA) is LAD, early reperfusion therapy of IRA by percutaneous coronary intervention (PCI) was done within the time window, restoration of vessel patency in major epicardial arteries, but, perfusion to the distal coronary microvasculature is not fully resored as consequence of impairment of MVP[7, 8]. high-frequency line probe combined with CEUS were used to assess the apical myocardial blood flow of anterior wall myocardial infarction patients after PCI, which is used to evaluate whether the MVP of the patients recover or not after the infarct-related artery is opened[9]. So, it can be a more sensitive and precise alternative method to distinguish impaired MVP patients after PCI. Therefore, promptly addressing it can significantly improve patient prognosis. So, it is promising to assess the microvascular perfusion of anterior wall myocardial infarction patients by high-frequency line probe combined with CEUS when successful PCI is achieved.
4. Although, this study demonstrate that observation of apical perfusion is feasible and quantitative analysis allows an accurate and convenient identification of LAD stenosis, this study did not evaluate outcome prediction nor risk stratification. In order to recommend this method as a diagnostic test

to identification of LAD stenosis, further comparative studies on risk stratification, management and cost-effectiveness need to be demonstrated.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual

contribution to the work and approved it for publication.

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