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Assessment of functional mitral regurgitation with leg lift and exercise echocardiography using the average pixel intensity method

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Background: Dynamic changes in functional mitral regurgitation (FMR) during exercise echocardiography were shown to be of prognostic value. However grading of FMR is challenging, especially during exercise echocardiography and therefore questioning its applicability in clinical practice. We recently introduced and validated the Average Pixel Intensity (API) for grading MR based on the pixel intensity of the continuous wave Doppler signal. In the current study we investigate the use of the API method using leg lift and exercise echocardiography in FMR.

Methods: We prospectively included 50 heart failure patients (mean ejection fraction 36%) in sinus rhythm with different grades of pure, FMR. After assessment of FMR severity at rest, the same acquisitions were repeated during leg lift and exercise echocardiography. FMR was assessed using the API method, color Doppler and quantitative grading methods (proximal isovelocity surface area (PISA) and vena contracta width (VCW)).

Results: The API method could be performed in all patients (100%) with leg lift (n = 50) and in 94% of the patients undergoing exercise echocardiography (n = 44), which was more than PISA and VCW ($p < 0.001$).

During leg lift, there was a small but significant increase on visual color Doppler grading (grade 1.93 to 2.11 ($p = 0.004$); increase of FMR in 35% of patients, and no difference in 65%). For API, we found the same significant increase (93 to 101 au), however, API values showed increase of MR in 62% and decrease of FMR in 20%.

During exercise echocardiography, we found no differences in color Doppler grade and API in the overall cohort (p 0.252 and p 0.832, respectively), despite 62% of patients showing some degree of increase in API during leg lift. On multivariate analysis, no specific echo parameter could be identified as independent predictor of API increase.

Conclusions: The novel API method is highly feasible for assessing dynamic FMR and may be of added value for in this setting, allowing the detection of even small increments of FMR severity.

In the current study, we found only mild increases of FMR during exercise echocardiography. Leg lift testing however proved to be a simple and quick loading approach that induced a significant rise in FMR compared to exercise echocardiography. The prognostic relevance of the findings during leg lift remains to be determined.