Comparative assessment of chronic primitive mitral regurgitation severity by transthoracic echocardiography and 4D flow MRI

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Topic(s):
Cardiac Magnetic Resonance: Flow Imaging

Citation:
European Heart Journal - Cardiovascular Imaging (2019) 20 (Supplement 2), ii402

BACKGROUND: Chronic primitive mitral valve regurgitation (MR) is currently primarily assessed by transthoracic echocardiography (TTE) but remains difficult to evaluate as it lacks a true gold standard. Time-resolved phase-contrast magnetic resonance imaging with flow-encoding in all three spatial directions (4D Flow MRI) appears as an emergent tool that could contribute to help in MR quantification.

AIM: To study the agreement between TTE and 4D Flow MRI in chronic primitive MR to determine whether this new technique can be integrated to the multiparametric approach of this valvulopathy, as conventional MRI.

METHODS: We conducted a monocentric, prospective study at the Institut Mutualiste Montsouris (Paris, France) between November 2016 and 2017 including patients with chronic primitive MR of all mechanism. MR was evaluated with a multiparametric approach by two cardiologists in TTE and also quantitatively by two radiologists in 4D flow MRI. It was in both cases classified as mild, moderate or severe and then evaluated with consensus if disagreement. Operators were independent with blind evaluation. 4D Flow measurements consisted in quantifying direct MR regurgitant volume (RV) and MR regurgitant fraction (RF) and in indirect control of these values (calculated as subtraction of aortic or pulmonary forward flow from anterograde mitral flow). A comparison between 4D anterograde mitral flow and left ventricular stroke volume in cine-MRI was also conducted.

RESULTS: 33 patients were included. Interobserver agreement was good in TTE (kappa= 0.75 IC 95% [0.57- 0.92]) and excellent in 4D Flow MRI (ICC= 0.94 IC 95% [0.79-0.95]). Agreement with TTE was excellent after secondary adaptation of severity thresholds (Mild VR=20mL FR=20%, Moderate VR=[21–39]mL FR=[21–36]%, Severe VR=40mL FR=37%): kappa= 0.93 IC 95%(0.8-1] for RV and kappa= 0.9 IC 95%[0.7-0.9] for RF. Controls with indirect measurements showed excellent agreement between direct 4D Flow RV measures and subtractions of respectively aortic and pulmonary forward flow from anterograde mitral flow (ICC= 0.93 IC 95% [0.87-0.97] and ICC= 0.93 IC 95% [0.85-0.96]). Agreement between 4D anterograde mitral flow and left ventricular stroke volume in conventional MRI was also excellent ICC= 0.92, IC 95% [0.85-0.96].

CONCLUSION: 4D Flow MRI is a reliable and consistent tool for MR quantification. A future study to confirm the thresholds hereby obtained will comfort the role of 4D Flow MRI in MR diagnostic and therapeutic algorithm.