Reviewer's report

Title: Echocardiographic evidence of left ventricular untwisting-filling interplay

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Reviewer: Miroslaw Kowalski

Reviewer's report:

The paper analyzes an important issue of LV diastolic myocardial properties by measurement of diastolic intraventricular pressure gradient (DIVPG). The mathematical concept refers to the calculation of the instantaneous pressure difference between the LV base and apex. Such a measurement was feasible and proposed some time ago but it did not reach clinical significance. In the paper provided DIVPG estimation was highly reproducible. The team is currently working on the clinical software for computing DIVPG. Such a tool would allow to investigate the strength of LV sucking and improve the diastolic myocardial characterization in the clinical setting. The concept of the paper is scientifically and clinically attractive. The data of 154 subjects were analyzed which makes the study comprehensive and valuable. The main issue raised was high correlation between DIVPG and peak untwisting rate (r=0.73, p&lt;0.001). Their interdependence indicates a strong physiological coupling between the ventricular sucking and the myocardium relaxation. On multivariate analysis, DVP turned out to be the only parameter associated with peak untwisting rate. There was an interesting analysis of diastolic function with age, chronic exercise training, body mass index, sex difference. Correlations between untwisting rate and DIVPG were not significantly different before and after leg raising. The paper shows a huge difference between DIVPG and myocardial untwisting in terms of technical aspects. Speckle tracking method is more time consuming and gives poor reproducibility which results in a small number of projects on LV rotational movements. In contrast to the myocardial rotational behavior, DIVPG gives better insight into the diastolic properties as the number of data exclusions was very small.

It is still unknown how well we can define untwisting-filling interplay but such attempts should be made. In the assessment of LV diastolic properties the traditional parameters seem to be insufficient. Most of the parameters were taken into regard in the paper analyzed. The common indices referring to diastolic function did not correlate well (peak E, e', Esr, Vp) with both peak DIVPG and peak untwisting rate. Only E/e' inversely correlated with DIVPG. How to explain this observation? I am also curious what is the relationship between IVRT and DIVPG /untwisting rate. The authors assumed that the first negative deflection in the rotational velocity waveforms represents peak untwisting rate in the isovolumetric relaxation period whereas this was not measured in reference to the time of mitral valve opening. I am slightly surprised why the systolic function definition was skipped in the analysis. I would be more satisfied with EF,
GLS, S' inclusion in the comparisons. The amount of DIVPG should be the result of prior systolic phase and myocardial systolic function. Summarizing, the paper is well constructed and well written. It deserves publication but I could do with some additional comments in regard to the issues raised.

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