Applications of Myocardial Strain Study Using Two-Dimensional Speckle-Tracking in Pediatrics

There Is Enough Strain on The Heart to Rely on Half Beats

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In this refined review on the use of strain combined with the two-dimensional speckle-tracking echocardiography in pediatrics, Professor Gabriela Leal summarizes the advantages and disadvantages of using the strain. The speckle-tracking technique, which means "tracking myocardial spots", is based on the fact that ultrasound produces speckles. Thus, an item of software will allow to track approached speckles during systole and a larger speckle-to-speckle distance during diastole. The closer speckle-to-speckle distance is during systole and the larger it is during diastole, the better the strain imaging, which may be considered a myocardial contractility parameter, as opposed to other two-dimensional or three-dimensional parameters, such as fractional shortening and ejection fraction, which are based on changes in size or volume and, therefore, are substitutes for cardiac function, but fail to evaluate myocardial contractility. The author summarizes the use of left ventricular (LV) strain and right ventricular (RV) strain, right and left atrial strain, and fetal strain.

Left ventricular (LV) strain is detailed in the various acquired heart diseases as a cardiopathy secondary to the use of anthracyclines, juvenile systemic lupus erythematosus, myocarditis and dilated cardiomyopathies, cardiac post-transplantation, Duchenne muscular dystrophy, mucopolysaccharidoses, Pompe disease, Kawasaki disease, Pediatric sepsis, Chronic Renal Failure (CRF), HIV infections and thalassemia. Low strain values or changes in strain values for all of these health conditions have shown a subclinical myocardial dysfunction (before changes in ejection fraction occurs or symptoms are present) and may be used to initiate treatment (as in the case of muscular dystrophies), are predictors of mortality or morbidity and may be used for risk stratification, as in the case of Kawasaki disease and pediatric sepsis.

The use of the right ventricular (RV) strain needs to take into account changes in the contractility pattern that occur in situations such as tetralogy of Fallot, systemic RV, single RV and cardiac post-transplantation. In several of these situations, the RV assumes a circumferential contractile pattern, which resembles to that of the LV and, therefore, falls in RV longitudinal strain values do not necessarily indicate RV dysfunction. Pulmonary hypertension is one of the ideal situations for the use of strain to evaluate RV function. In this population, strain is a sensitive outcome predictor and has a good correlation with other clinical markers, such as Natriuretic Brain Peptide (NBP). It is worth noting that, in systemic RV and single ventricles, the RV contractile pattern resembles to that of the LV, and the circumferential strain should be used, as pointed out by the author.

Atrial strain has received great attention, with several studies published recently. Our service in Philadelphia, as pointed out by Dr. Gabriela, demonstrated that reductions in longitudinal right atrial strain in children with pulmonary hypertension are shown to be superior to conventional parameters when used to detect morbidity and mortality. Left atrial strain needs further studies to prove its clinical usefulness. Fetal strain has already been investigated in maternal diabetes, demonstrating changes in RV and LV functions, but its clinical use still needs to be defined.

Dr. Gabriela points out that, once normal values in pediatrics are available, the use of strain must be implemented, while other modalities (fetal strain) require further studies to be clinically implemented.

Keywords

Revision; Strain; Pediatrics; Myocardial deformation.

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